




# FINAL REPORT

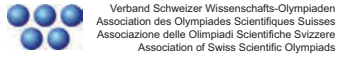
IBO 2013, JULY 14-21, 2013



Thank you to all who made it possible through their support and help to organize and realize the IBO 2013.

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 Organizers



UNIVERSITÄT  
BERN

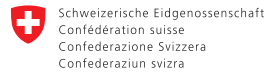
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**COVER:**

**LEFT** Bern, Clocktower, Rich Seymour / iStock.

**MIDDLE** IBO 2013 - practical exam in systematics, a student measuring the skull of a mammal, Hoang Pham/IBO 2013.

**RIGHT** Trypanosoma, Prof. Andrew Hemphill (Institute of Parasitology, University of Bern).

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# Editorial



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## Dear all

The 24<sup>th</sup> IBO is history now, even if we have been still working on it for quite a long period of time. We will carry the wonderful memories for ever in our hearts. And actually, there has been no emotional emptiness straight after this huge event since there were enough other challenges.

In the meantime we analysed the IBO 2013 and I am still able to say – as I did immediately after the event – the IBO 2013 was a big success. Many of the innovations we boldly implemented have been welcomed enthusiastically and have set new standards, for example the changes in the weekly programme, the translation software and the computer tablet based theory exams. There were no major problems, minor ones have been carefully analysed and transparently solved. The feedback from the majority of the delegations was enthusiastic and appreciative.

Could we have dreamed any better?

Let's hope we and Switzerland with our culture, way of solving challenges or sharing knowledge could offer all of the participants and jury members a unique experience, a lot of joy, sustainable new friendships and inputs for their future lives.

### **Knowledge is one of the few things that doubles when you share it. So does joy.**

Once more, I wish to thank the University of Bern, the Association of Swiss Scientific Olympiads, the Natural History Museum of the Burgergemeinde Bern, the city of Bern, the canton of Bern, the State Secretariat of Education, Research and Innovation SERI, the Principality of Liechtenstein and all our supporting partners for their commitment. Only your reliable and huge support made the IBO 2013 as the first international science Olympiad in Switzerland possible. Last but not least, I want to thank again our volunteers who did an amazing job during the week.

We hope you enjoyed the IBO 2013 in Bern and will come back soon.

Thank you.

**Mathias Wenger, MD**

Chairman IBO 2013



Students of the IBO.

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Opening Ceremony - the colorful flag parade with the delegations from:

**TOP:** Thailand.

**BOTTOM LEFT:** South Africa.

**BOTTOM RIGHT:** Sri Lanka.

# 1. Preface

It was an honor for the Swiss Scientific Olympiads Association and the University of Bern to host the 24<sup>th</sup> IBO 2013, the biggest ever with 62 delegations. As the IBO 2013 chairman Mathias Wenger pointed out, a dream came true for those youngsters who, back in 1999, formed the first Swiss delegation to participate in such an event. As a matter of fact, the IBO 2013 was mostly organized by and carried the mark of those former participants. Considering all persons involved in the organization of the IBO 2013, it was the youngest team ever to take up this challenge as the IBO Chairman, Poonpipope Kasemsap, stated. This had quite an influence on the preparation of this event.

Nevertheless, besides this group of former participants and in order to organize the IBO professionally, a special and very small organization was put into place – separating the scientific aspect of all others with two separate project managers responsible for each part. The administrative project management also featured a head of secretariat/project coordinator. This 3-persons operative team worked part-time on a temporary basis and additional members joined for short periods of time. While preparing the IBO, the organizing team made the decision to take some risks and try to implement several novelties in the IBO, focusing on two main fields of action:

- Find an answer to the problematic lack of time for the jury sessions by introducing an especially developed computer program to help the translation and by modifying the week's schedule in order to give more time to the jury
- Introduce computers in the exams

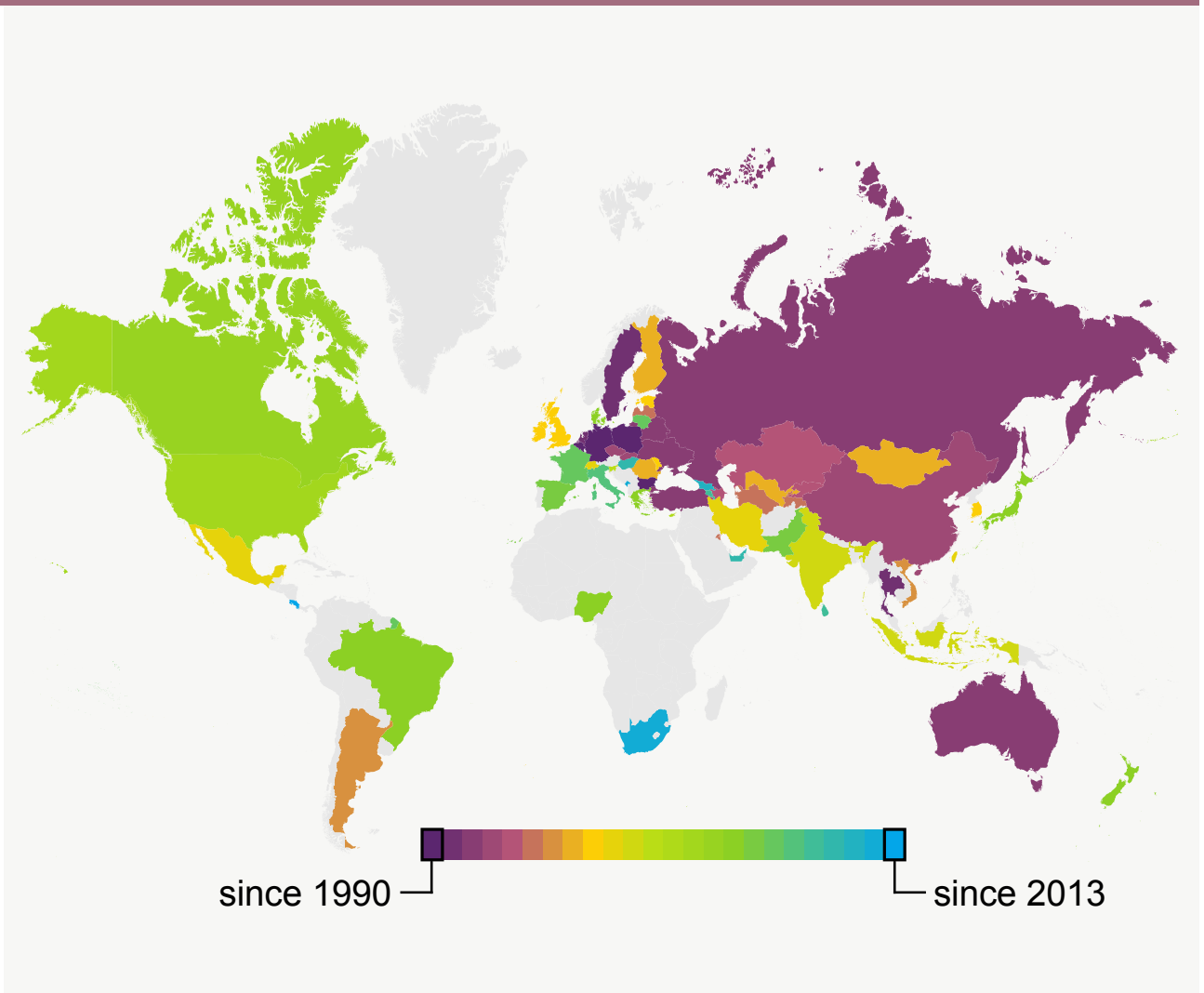
But maybe the most important challenge was the choice made about the type of exam questions and their wording. This ended up in an enormous amount of hours invested in each question so that they would respond to the high demands of the scientific management.

Another aspect put pressure on the project team: the financing of the IBO – which had mostly to be ensured through fundraising – turned out to be quite difficult and was only secured by the end of 2012. Many more challenges had to be addressed, especially about the infrastructure and the special needs of an IBO as Bern is a small city which in turn had also very specific advantages. Nevertheless, the IBO team had the ambition to fulfill the high expectations.

We would like to express our gratitude for the support and trust of all our financing partners and also for the goodwill from many suppliers we were lucky to encounter while preparing the IBO. Last but not least, special thanks go to the volunteers who were exceptionally committed to the IBO and made an extraordinary contribution to its success.

Organizing the IBO 2013 turned out to be an adventure with many challenges and highlights, demanding the best of all involved persons. It was an intensive and great experience.

In order to share our newly won expertise, we decided to write quite an extensive and transparent final report about the 24<sup>th</sup> IBO, not only concentrating on the scientific results analysis, but also summarizing our experience about the organization as a whole. We hope it will help future organizers.



**FIGURE 2.1** IBO members color coded by the year of their first participation.

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# 2. IBO in a Nutshell

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## 2.1 Wording

In order to put an end to the confusion about the differentiation between jury and observers, a decision was made about the terms and their definitions at the AB Meeting, November 2012. Henceforth, the following wording was used:

- Jury members – accompanying persons and members of the delegation of a country. The standard delegation consists of up to four students and 2 jury members
- Additional jury members – more delegation members taking over tasks as a jury
- Observers – representatives of countries not yet members of the IBO, who attend to observe as a condition before becoming a full member and being allowed to send an own delegation to participate in an IBO, as stated in the syllabus
- Visitors – persons who do not officially represent the country and consequently do neither take part in the jury sessions nor contribute to the discussion of the IBO test questions. They are allowed to participate in the evening program, excursions and ceremonies

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## 2.2 Facts and Figures

The 24<sup>th</sup> IBO, the biggest ever, was hosted by the Swiss Scientific Olympiads Association and the University of Bern:

- July 14-21, 2013
- In Bern, federal city of Switzerland
- 62 delegations
- 2 observer countries
- Total of 457 guests:
  - 240 students
  - 205 jury members (jury and additional jury)
  - 3 observers
  - 9 visitors
- 70 volunteers
- 145 medals distributed (25 gold, 46 silver and 74 bronze)
- 22 certificates of merit

The Principality of Liechtenstein contributed to the organization of the IBO 2013 both with financial and with human resources.

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### Budget

The IBO 2013 was mostly financed by fundraising.

- Budget: CHF ~ 2.3 Mio, effective costs CHF ~2 Mio
- Lowest Fees:

Delegation	CHF	950.–
Additional Jury	CHF	1,700.– pp
Observer	CHF	1,700.– pp
Visitor	CHF	1,400.– pp



Arrivals Zurich Airport, July 14, 2013.



Shuttle to Bern on arrival day.



Volunteers preparing gift bags.

# 3. Organization

Switzerland has been commissioned to organize the IBO 2013 at the coordinators' meeting 2008 in Mumbai, India, after submitting its candidacy in 2006. The project was supported by the former State Secretariat of Education and Research (Swiss equivalent to the Ministry of Education), now State Secretariat of Education, Research and Innovation SERI and the University of Bern. Eventually, the IBO 2013 organization was legally established as an ordinary partnership between the Association of Swiss Scientific Olympiads with its member ibolsuisse association and the University of Bern according to art. 530 ff. Swiss Code of Obligations.

In Switzerland, Scientific Olympiads are organized by independent associations (one of them being the Swiss Biology Olympiad (SBO) ibolsuisse association), all reunited in the Association of Swiss Scientific Olympiads (ASSO). Given the particular nature of the Swiss educational system, they are not a part of the Swiss federal educational system; however they provide an additional service to schools, teachers and students. While all members of ibolsuisse are volunteers, the ASSO consists of a small office with very few employees. Both ibolsuisse and ASSO have neither the manpower nor the financial capacity to organize an International Scientific Olympiad. Therefore, a separate project organization was put in place for the IBO. Its main characteristic was a dual project management with a scientific and an administrative project manager reporting to a steering committee. The project managers were employed on a temporary basis for their skills in their specific area of work. The indispensable insider knowledge about the IBO was ensured by the involvement of longtime members of the IBO, among others the chairman of the steering committee and the scientific project manager.

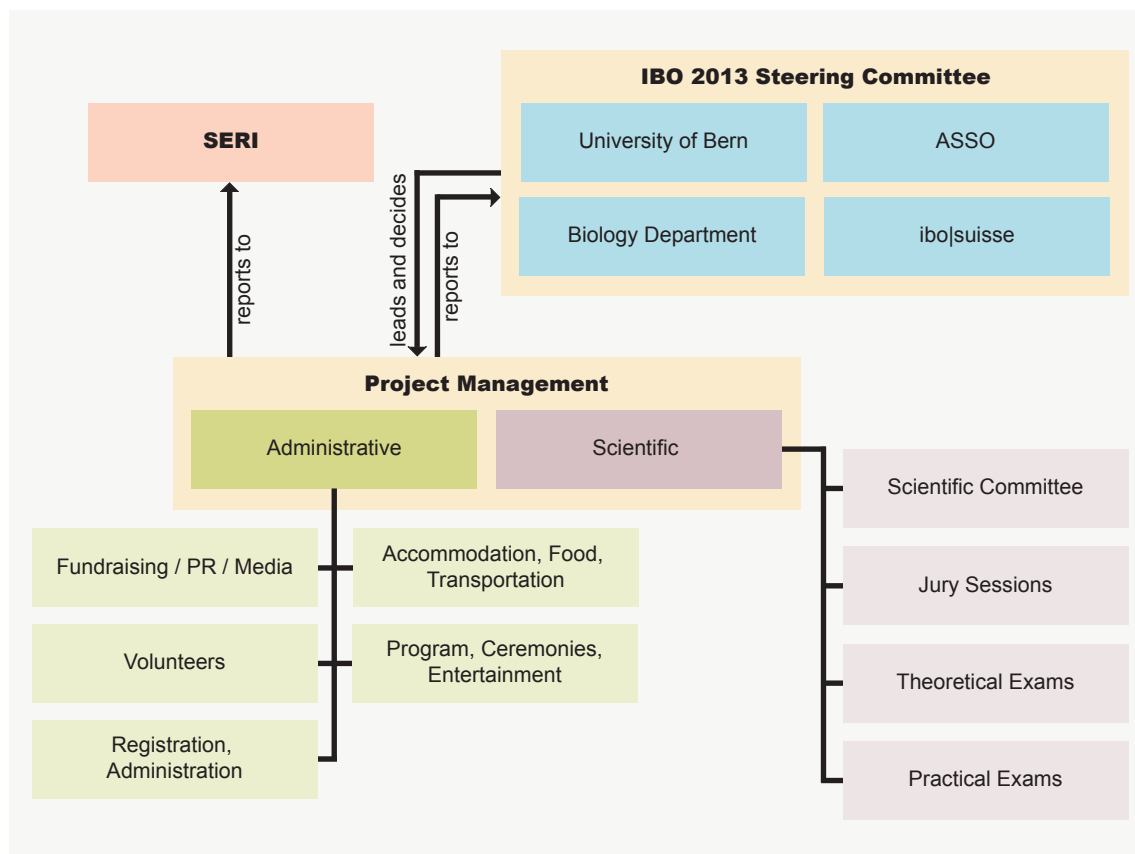


CHART 3.1 Organization Chart IBO 2013.



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## 3.1 Steering Committee

The steering committee was responsible for all strategic decisions concerning the organization of the IBO and supervised the work of both project managers.

The members of the steering committee were representatives of all institutions involved in the realization of the IBO:

- **Chairman:** Mathias Wenger, MD, Association of Swiss Scientific Olympiads
- **Members:** Natalie Baumann, University of Bern, Institute of Biology  
Michael Jutzi, Vice-President Swiss Biology Olympiad ibo|suisse  
Marco Hollenstein, University of Bern, Vice-Rectorate Development  
Marlis Zbinden, Director of the Association of Swiss Scientific Olympiads

Due to its small size (only one secondary/high school) the Principality of Liechtenstein has been working very closely with ibolsuisse for its national biology Olympiad and was therefore involved in organizing the IBO 2013. Helmut Konrad, State School Board (Schulamt) of the Principality of Liechtenstein, was a guest member of the steering committee.

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## 3.2 Management

### 3.2.1 Project Management Administration

The project management administration was in charge of all operative and administrative aspects of the week's program, i.e. all that had not a downright scientific essence (i.e. exams, jury sessions). At the beginning, the team consisted of 2 persons. A third person joined in the last months before the IBO:

- **Project Manager:** Irène Steinegger-Meier, M Sc
- **Head of Secretariat, coordinator:** Marco Gerber, M Sc
- **Assistant:** Ayse Turcan

The project manager started her part-time work on June 2011 at a low employment percentage (40%) but due to the complexity of the work the percentage was soon raised (60-80%). Soon thereafter, the head of secretariat was hired to complete the "team" in a part-time position. He started out with 40%, increasing steadily to 80%. Both Irène and Marco have university degrees. Even though their job was not scientific, its complexity requires highly qualified employees. Knowhow of the functioning of the IBO would be an additional asset, however not imperative. For the last half year, an assistant came to reinforce the team, also on a part-time basis. From January to July 2013, the work percentage amounted to about 210-250%.

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### 3.2.2 Scientific Management

- **Scientific Project Manager:** Prof. Daniel Wegmann

The scientific project manager started with the preparation of all scientific aspects of the IBO in November 2011 with a 50% part-time job. For this job, excellent scientific qualifications in biology are imperative, and knowhow of the functioning of the IBO is an additional asset. Daniel met these requirements in an ideal way. In 2013, a supplementary task force of three

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persons was employed to support him without counting the immense preparation work done by many members of the ibolsuisse association on a voluntary basis. On top of that, many more persons were involved in one way or the other in the preparation of the exams and especially in the development of the new computer program to facilitate the work of the jury and to prepare the computerized exams.

The real amount of work invested in this part of the organization is nearly impossible to state but it is safe to estimate that over the 2 years preceding the IBO, a workload of about 150% is realistic.

## Scientific Committee

The exams were organized by a scientific committee, which was composed of various people bringing complementary expertise. For a proper function of the large committee, it consisted of several subcommittees interacting in clearly defined ways, as outlined below.

The committee was co-chaired by

- Scientific Project Manager of the IBO 2013, Prof. Daniel Wegmann
- Head of the Department of Biology of the University of Bern in 2013, Prof. Michael Taborsky

The two chairs had very different tasks with Prof. M. Taborsky acting as the spokesman of the committee both within the University of Bern as well as for the public. Prof D. Wegmann, on the other side and given through his function as scientific project manager, took executive responsibility for all exams.

For both exams, members with a long experience in National and International Biology Olympiads acted as a review committee that was in charge of assuring the expected quality of the exams and the formal requirements of an IBO, as well as harmonizing the exams regarding their design and difficulty. Members of the review committee also acted as executive members of the scientific committee and were in charge of implementing the exams during the IBO. The review committee was composed of

- Prof. Daniel Wegmann, Scientific Project Manager IBO 2013
- Thierry Aebischer, ibo|suisse
- Adeline Colussi, ibo|suisse
- Michael Jutzi, ibo|suisse
- Mathias Wenger, MD, ASSO, Chairman IBO 2013
- Matthias Gappisch, Principality of Liechtenstein

As outlined in Section 6, the review committee received most of the scientific input from active researchers from the Department of Biology of the University of Bern. For the practical exams, each institute of the department as well as the Natural History Museum of the Burgergemeinde Bern were in charge of preparing the experimental protocols later used during the IBO. To guarantee these protocols would satisfy requirements of the IBO, the people responsible from the different institutes were paired up with an executive member of the scientific committee during the development of the protocols.

The members of the committee responsible for the different practical exams are listed in the table below.

Practical	Institute	Person in charge Institute	Person in charge Swiss Biology Olympiad
1 - Cell	Institute of Cell Biology	Prof. Isabel Roditi Andreas Gruber	Adeline Colussi
2 - Plant	Institute of Plant Science	Prof. Doris Rentsch Stefan Meier, PhD	Michael Jutzi
3 - Etho	Institute of Ecology and Evolution	Prof. Michael Taborsky Joachim Frommen, PhD	Thierry Aebischer
4 - Syst	Natural History Museum <sup>1</sup>	Stefan Hertwig, PhD Christian Kropf, PhD	Thierry Aebischer

**TABLE 3.1** Institutes and people in charge of organizing the practical exams.

<sup>1</sup>The Natural History Museum of the Burgergemeinde Bern is not an institute of the University of Bern, but an independent Institution of the Burgergemeinde of the city of Bern. The museum has a long tradition in collaborating with the Department of Biology of the University of Bern.

Similarly, one person from each of the three institutes was responsible to communicate between the scientific committee and the researchers in their respective institute regarding the writing of theoretical questions. These were:

- Gerald Heckel, PhD, Institute of Ecology and Evolution, University of Bern
- Daniel Prati, PhD, and Oliver Bossdorf, PhD, Institute of Plant Science, University of Bern
- Christa Rhiner, PhD, Institute of Cell Biology, University of Bern

Finally, the theoretical questions were also reviewed by a committee of high school teachers to aid in adjusting the level of difficulty and to assure many formal requirements. The members of this committee were:

- René Gfeller, Gymnase de la Cité de Lausanne
- Markus Jordi, Gymnase Auguste Piccard Lausanne
- Matthias Gappisch, Gymnasium Vaduz, Principality of Liechtenstein

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## 3.3 Patrons' Committee

A patrons' committee involving known personalities was put together. They brought in their reputation to support the organization of an IBO in Switzerland enhancing its importance for future research, education, industries, economy and society as a whole.

- Prof. Patrick Aebischer, President of the EPFL
- State Councillor Isabelle Chassot, Director of Education, Canton Fribourg, President of the EDK
- Martine Clozel, MD, Co-Founder Actelion, Chief Scientific Officer
- Mauro Dell'Ambrogio, PhD, Secretary of State for Education, Research and Innovation SERI
- Prof. Felix Gutzwiller, Institute for Social and Preventive Medicine, University of Zurich, Member of the Council of States
- Prof. Michael Hengartner, Institute of Molecular Life Sciences, University of Zurich
- Reto Naef, PhD, Chair KGF, PBO Head Scientific Affairs, Novartis Pharma AG
- State Councillor Bernhard Pulver, PhD, Minister of Education, Canton Bern
- Prof. Isabel Roditi, Co-Director Department of Biology, Institute of Cell Biology, University of Bern
- Prof. Daniel Scheidegger, Member of the Swiss Science and Technology Council, SSTC
- Prof. med. Martin Täuber, Rector, University of Bern
- Prof. Martin Vetterli, President of the National Research Council, Swiss National Science Foundation
- Prof. Daniel Wyler, Vice-President Medicine and Science, University of Zurich
- Prof. em. Rolf Zinkernagel, University Hospital Zurich, Nobel Prize of Physiology or Medicine



Registration: distribution of the IBO 2013 t-shirt.



One of many group pictures taken during the IBO 2013.



Use of tablets during the practical exams.

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# 4. Innovations

Science and research are based on innovation and on scientists' courage to try and err. Switzerland was ready to implement some changes in order to address some of the challenges of the IBO:

- Over the past years the time shortage for the jury to debate and translate the exams was often discussed at the IBO. Every year, most delegations had to work a night shift in order to finish on time. This was not satisfactory as the risk of errors grew and eventually led to consequences for the students.
- As the IBO grows bigger every year, the issue of the setting and the necessary infrastructure gets more and more important. In order to meet this challenge, an early estimation of the number of participants is of great importance.
- The increasing number of students calls for more efficient marking systems. In addition, the work of the jury did not profit from the far reaching changes information technology has brought to science, education and the society as a whole. To change this, we introduced digital solutions to support the jury in their translation and discussion effort, as well for testing purposes.

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## 4.1 Program, Fee System and More

### 4.1.1 Program

According to the traditional program of the IBO (see syllabus), the discussion and translation of the practical exams would begin on Monday afternoon (exam on Tuesday), whereas the preparation of the theoretical exam would start on Wednesday morning (exam on Thursday). In order to increase the time at disposal for these central tasks of the jury, the week's schedule was changed as follows:

- Arrival, registration and opening ceremony on Sunday
- Start of the discussion and translation of the practical exams on Monday morning, i.e. half a day more
- Start of the discussion and translation of the theoretical exams on Tuesday morning, consequently allotting one more day (and night) for the task

These changes were accepted at the Coordinators' Meeting in Singapore and confirmed at the AB Meeting 2012.

This amount of time gained for jury work meant that a half-day excursion had to be cancelled. The usual Tuesday evening meeting of jury and students was replaced by a reception at the Natural History Museum of the Burgergemeinde Bern where jury members had the opportunity to meet the scientists of the University of Bern and of the Museum.

These changes made it possible for all jury members to take part in the discussion about the exam questions if they wished to do so and to come to an end with the translation early enough to have a second look at it while still finishing the task at an acceptable time. This was clearly considered a positive change. It does not seem that the usual encounter with the students was much missed.



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### 4.1.2 Fee System

Two main reasons lead the Swiss organizers to introduce a scaled fee system as used in most scientific conferences and meetings.

First, a central concern of the organizers was to make sure that the fee would not be an obstacle for participation to any IBO member delegation. Although Switzerland had to finance the IBO mostly through fundraising, and it turned out to be quite a challenge, the delegation fee was set extraordinarily low.

Second, the growing size of the IBO makes it difficult to find suitable facilities, accommodations and other infrastructure, especially in a small city such as Bern. Therefore, it was very important to have a good estimation of the number of guests as early as possible.

The scaled fee system guaranteed the lowest fee to the “early birds” who registered at an early time point, rising gradually while getting nearer to the effective date of the IBO. Note that Switzerland asked in a first step only for a registration of delegations without any names by the beginning of March (while the syllabus states that the confirmation of the participation has to be done by the end of January) and time was given for names till May 25<sup>th</sup>.

A low alteration fee ensued from any changes made after the deadline.

Thanks to this system, 90% of the delegations and over 85% of the individuals had registered before March 2013, allowing early decisions to be made (see 5.7.2 TABLE 5.10). It also made it possible for some countries to bring in more jury members at an acceptable price.

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### 4.1.3 Yearbook and a Daily Video Blog

Another innovation we would like to mention is the distribution of the “Yearbook IBO 2013” with pictures, names and contact information about all participants, volunteers and organizers of the IBO, as far as the information was given free for printing, which has been mostly the case. This turned out to be a much appreciated novelty as the evaluation scores show (see 7.1.2 CHART 7.16, and 7.2.2 CHART 7.37).

Finally, a daily video was put online every day, providing a different, subjective but lively and emotional perspective, completing the information given through the daily newsletter “messenger IBO”. These 2-3 minutes videos were widely clicked on and allowed the families and friends at home an insight in the happenings of the IBO 2013.

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## 4.2 Exams

A major change to the translation and testing system of the IBO was initiated by the introduction of software that aimed at facilitating the translation and discussion work of the jury, as well as to transform the translated exams such that the participants could answer the theoretical exam digitally. This not only greatly reduced the amount of work invested into marking, it also allows for much more detailed statistical analysis of the exams, and hence to improve the quality of the IBO in the long term.

As outlined in section 6.2.3, the central piece of the developed software was the development of a well suited general markup language for exam design, embedded into a clever versioning system that allowed to easily keep track of all changes to questions during the development as well as the jury sessions and was capable of matching single snippets across languages, also within figures and tables. This allowed the jury to focus on translation without the need to bother about formatting issues, but also enabled the participants to see a specific question in a different language with a simple click.

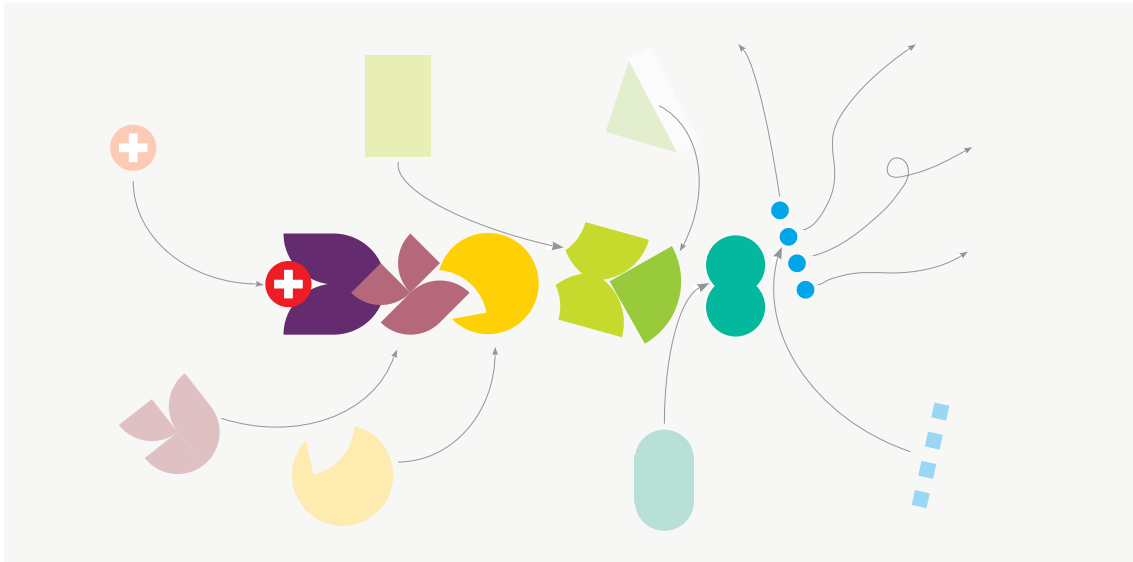
Since students were taking the exams digitally, it also allowed us to track their progress through the exam. The collected data thus aided to assess general statistics regarding the quality of the exam such as the difficulty of each question and the time devoted to each question. It further allowed us to address basic questions regarding exam design and the strategy of students solving them, such as the net benefit of revisiting questions or the correlation between the actual difficulty of a question and the assessment of the jury.



High concentration is demanded at practical exams.

# 5. IBO 2013

## 5.1 Logo



For most people the IBO 2013 logo was a surprise although the overall reaction was positive. The IBO 2013 decided not to represent the DNA spiral, animals or plants that are easily identified with biology. Instead, the focus was on other parts of modern biology with the abstract representation of signal transduction. The IBO 2013 logo shows a very simplified version of this fundamental biological process by which a biological cell reacts to external information. The signaling pathway is started by the interaction of a hormone – represented by the Swiss banner – with a receptor. This input will be transmitted through the whole cell by a multitude of proteins and ends up with a cellular response, represented by the four blue dots.

According to the organizers of IBO 2013, this process has a lot in common with the IBO as it sends out new signals in scientific education. The young participants receive an important input, enabling them to gain new experiences and acquire additional skills. They will enlarge their knowledge in biology, meet new and foreign cultures and get to know many young people from all over the world. IBO 2013 in Switzerland wished to inspire young scientists and affect their future activities positively.

## 5.2 Funding

The success of the IBO, its growing, has obvious consequences on the complexity inherent to the organization of an IBO but especially also on its financial aspects. The size of the IBO, the number of participants, the increased needs in terms of logistics, IT and infrastructure is coupled with higher costs. As a consequence the budget could turn out to be a bigger problem each year for countries willing to organize this event.

Switzerland's situation may be considered as particular, as the associations in charge of the Olympiads and the IBO 2013 organization are funded through fundraising. Science Olympiads in Switzerland are not state institutions and therefore need to raise their own funds. Only a start financing was granted by the State but nobody was ready to take up a deficit guarantee. This

meant that if the financing could not be ensured, the realization of the IBO was questioned as otherwise the financial basis of the Association of Swiss Scientific Olympiads could be jeopardized. Both options were certainly not satisfying.

It was therefore of the utmost importance to be able to plan as soon as possible the expenses, i.e. have a good estimation of the number of participants in order to take the necessary steps against these risks.

But then, there still was another point to consider. Swiss organizers early on made the decision to set a very low delegation fee in the belief that fees should not be a reason for any country to decide against a participation in the IBO 2013, especially in times of financial disarray, as already the trip to Switzerland could represent quite a financial burden for many countries.

### 5.2.1 Fees

With respect to the points outlined above, the idea to implement a scaled fee system came up early in the preparation of the IBO and was considered to be a good solution to meet various demands:

- Countries usually know quite soon, if they will take part in the next IBO. There should therefore be no difficulties to announce the participation early, especially as no names or details were asked for at an early stage.
- As a result, the organizers had an early enough estimate about the number of delegations and were then able to extrapolate an approximation about the number of participants. As a consequence, infrastructure could be organized quite early and better prices negotiated.
- Last but not least, the system of scaled fees is already implemented and used for scientific conferences, also with some additional costs that are induced when changes are made afterwards. Hence the organizers could expect most coordinators to be at ease with such a system; if not, support was supplied on demand.

The scaled fee system was set as follows:

Registration	Delegation (max. 4 students and 2 jury members)	Additional jury members (per person)
Till March 2, 2013	CHF 950.-	CHF 1,700.-
Till April 13, 2013	CHF 1,200.-	CHF 1,800.-
Till May 31, 2013	CHF 1,500.-	CHF 2,000.-
From June 1, 2013 onward	CHF 2,500.-	CHF 2,500.-

**TABLE 5.1** Newly implemented scaled fee system depending on status of participation and time of registration.

It must be stressed that none of the delegation fees (for 6 persons) but the highest one covered the cost of one guest for the week. The decision about such low fees obviously had quite an impact on the budget as the contribution of the delegations to the IBO would be modest and the missing sum would have to be compensated by raising funds elsewhere.

All in all, the income gained through fees summed up to slightly less than CHF 240'000.- or roughly 12% of the final budget.

## 5.2.2 Fundraising

Fundraising was of fundamental importance for the organizers but was extremely difficult because the IBO could not be advertised as a “traditional” sponsoring event for two reasons. First, sponsoring could not be achieved for legal and tax considerations specific to Switzerland and the organizing institutions. Second, the Olympiads are not classical sponsoring objects, at least not in Switzerland, due to their low key profile.

In order to ensure the financing of the IBO, one of the first steps was to create a fundraising concept. The underlying strategy was to ask first state organizations and larger foundations for support and in a second step to ask for the support by companies and the industry, as the IBO is not a classical sponsoring event. The objective was to secure 80% of budget by the end of 2012.

The concept based on 5 categories of financing partners offering them various benefits for their support. Our five categories of funding partners were

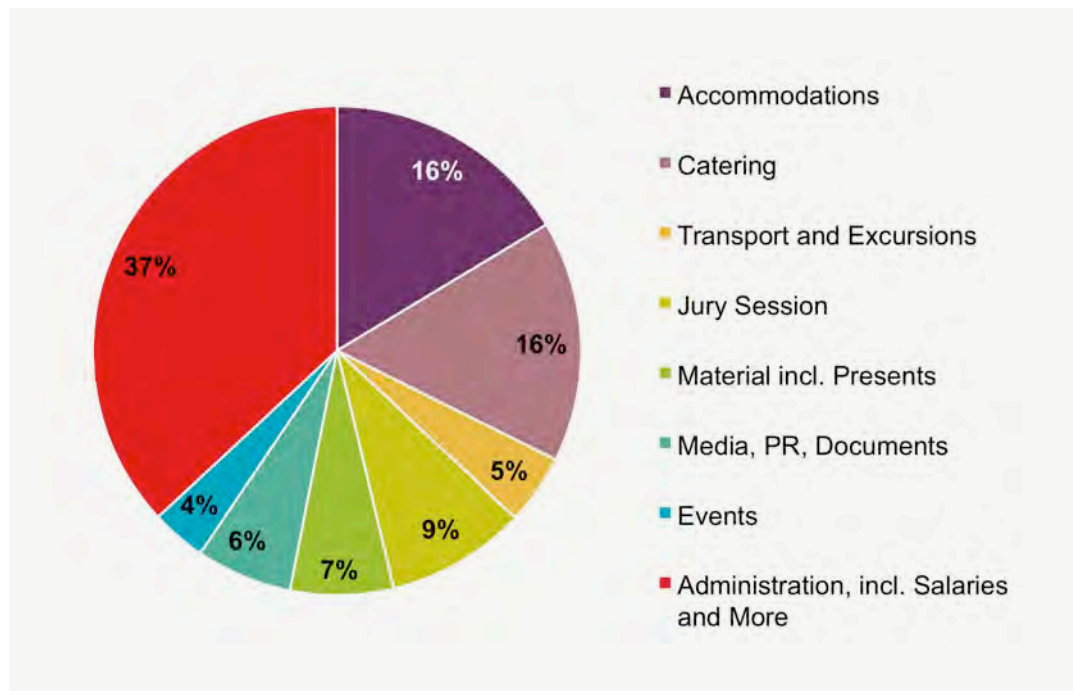
- Premium Partner: CHF 400'000.- and more
- First Partner: CHF 100'000.- up to CHF 399'999.-
- Partner: CHF 30'000.- up to CHF 99'999.-
- Premium Supporter: CHF 10'000.- up to CHF 29'999.-
- Supporter: CHF 1'000.- to CHF 9'999.-

The benefits offered were realized after consulting our partners, but basically they were:

	Premium Partner	First Partner	Partner	Premium Supporter	Supporter
Logo and link on homepage	■	■			
Name, size variable on website			■	■	■
Logo on brochures' and documents' first page	■	■			
Logo on documents' back page, size variable.			■	■	■
Logo at press conference	■				
Presence at ceremonies	■	■	■		
Logo at opening and closing ceremony on stage	■	■			
Logo at ceremonies on sides			■	■	
Logo on lab coat	■				

	Premium Partner	First Partner	Partner	Premium Supporter	Supporter
Use of logo IBO 2013	■	■	■	■	■
Mention on press release	■	■			
May offer special prize	■	■			

After a first positive feedback in the beginning, the flow of money dried up for most of 2012 and led the organization team to work out scenarios in case of continuing lack of funds. First steps were taken to react to the situation with an intensification of fundraising while making budget cuts (budget reduction of about one third) wherever possible but without affecting the quality of the event. Fortunately, by the end of the year, several requests, which had been pending for a long time, were positively answered. This meant that all financial needs based on the new budget were then covered and the team could concentrate on the core activity. This also meant that we could hire some much needed scientific assistants for the scientific project manager in order to meet the high quality demanded, as the formulation of the exam questions turned out to be much more intensive and time consuming (see chapter 6). The efforts put into this were more than legitimate as the quality of the questions was given high scores by the jury (see chapter 7). 86.9 % marked the practical exams with 4 to 5, i.e. good to over the expectations, whereas the theory exams reached the result of 79.7%. In terms of averages this would be 4.1 and respectively 4.04 points.



**CHART 5.1** Expenses IBO 2013 in percent of overall budget.

The final budget of the IBO was very lean in the end but still allowed us to offer a comfortable stay in Switzerland with interesting activities and excursions.

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### 5.2.3 Budget and Expenses

The budget eventually settled at roughly CHF 2 Mio from which expenses for infrastructure and logistics (accommodations, catering and transport with excursions) sum up to 37%, whereas the jury session with the necessary technical support accounts for 9%. Expenses for material make 7% of the total of expenses (most of which, i.e. 84%, is exam material). Altogether, the jury sessions and the exams take about 15% of the budget.

Finally, the overall budget was structured as shown in CHART 5.1.

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### 5.2.4 Contributions of University of Bern

The University of Bern generously contributed the following infrastructure and services:

- All university owned rooms used during the IBO (labs, lecture halls (exams and coordinators' meeting), offices)
- Office infrastructure
- Media support, administration human resources, IT (only regular office support; not the programming of the translation tools or tablets)
- Advice in legal matters, insurances, taxes
- Scientific assistance by university scientists for theoretical exams and, in case of three practical exams contributions to the preparatory works

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### 5.2.5 Contributions of Natural History Museum of the Burgergemeinde Bern

The Museum was an important partner for the IBO 2013 also because they supported one practical exam in its development and generously allowed the scientific management to use



Reception at the Natural History Museum of the Burgergemeinde Bern, jury members admiring the exhibition.



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their material, in this case the animal skulls enabling all students to work with real samples – a truly unique opportunity.

The Natural History Museum of the Burgergemeinde Bern generously contributed the following infrastructure and services free of charge:

- Scientific assistance and material (animal skulls) for one practical
- The Museum as a location for the jury reception dinner (Tuesday) and the students' lunch (Thursday)
- Entry to the exhibitions during both events

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## 5.3 Program

As mentioned in chapter 4.1.1, the program of the IBO 2013 has been adapted to give more time for the jury's work.

While the changes made it possible for the jury to invest more time in the discussion and translation of the exams this also meant that Sunday would be a very busy day with arrivals, registration and opening ceremony on the same day. A last minute change was also made during the IBO at the end of the week to give extra time for the exams' review on Saturday morning, altering by the way the possibilities to participate in the optional programs.

Mostly, the program received a positive feedback and the additional time for jury session was widely appreciated (over 78% considered it positive to very positive – see Chapter 7). As probably for all organizers, one of the main challenges was to find a good mix in the program taking into account the many different expectations and needs of multicultural guests but also the limitations due to high number of participants, the distances to the excursion sites and last but not least, our wish to present Swiss culture. Although the number of persons raised a few difficulties, the small size of Switzerland was also an asset as distances are comparatively short. In the following, a few program points are highlighted.

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### 5.3.1 Ceremonies

The ceremonies took place at the Kulturcasino of Bern, built at the beginning of the 20<sup>th</sup> century in the late baroque classicism style. The main room with its golden decoration offered a festive venue for both ceremonies. We were proud to welcome to the opening ceremony the highest Swiss Citizen, the President of the National Council Ms. Maya Graf who delivered a short speech, and from Liechtenstein the President of the Landtag (Parliament), Mr. Albert Frick as Liechtenstein participated in the organizing of the IBO 2013. All participants and guests were also welcomed by the City Chancellor of Bern. At the closing ceremony a representative of the Canton of Bern and one of the Swiss Parliament bid good bye. In order to keep the ceremonies within an acceptable length, the number of speeches and their duration was reduced to a minimum. A total of 145 medals – 25 gold, 46 silver and 74 bronze in the shape of one item of the logo (see appendix 8.3.4) – were distributed on stage. 22 certificates of merit were handed out together with the certificates of participation at the gala dinner following the closing ceremony.

	Students	Jury
<b>Sunday, July 14</b>	Arrivals and Registration	
	Opening Ceremony at the Kulturcasino Bern Welcome Dinner	
<b>Monday, July 15</b>	Review of Lab Equipment Visit of the City of Bern	Jury Session Discussion and Translation of Practical Exams
	Welcome Evening Ice Breakers	
<b>Tuesday, July 16</b>	Practical Exams at the University of Bern	Jury Session Discussion and Translation of Theoretical Exams
	Entertainment and Sports	Reception at the Natural History Museum
<b>Wednesday, July 17</b>	Emmentaler Show Dairy Mount Niederhorn St. Beatus Caves	Jury Session Discussion and Translation of Theoretical Exams
	Social Night	
<b>Thursday, July 18</b>	Theoretical Exams at the University of Bern	Visit of the City of Bern Review Practical Exams Coordinators' Meeting
	„Swiss Night“ at the Unitobler	
<b>Friday, July 19</b>	Natural History Museum Guided Tour of the Swiss Parliament Building Bundesplatz: “Biology around the World: Meet our Guests”	Review Exams Swiss Open-Air Museum Ballenberg Mount Niederhorn
	Social Night	
<b>Saturday, July 20</b>	Dählhölzli Zoo Bern	Free Time / A Choice of Excursions or Educational Session
	Closing Ceremony at the Kulturcasino Bern Gala Dinner and Farewell	
<b>Sunday, July 21</b>	Departures	



**TOP** Ice Breakers for students on Monday evening.

**BOTTOM** How to make cheese: a students' excursion to the Emmentaler Show Dairy.

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All ambassadors of the countries with delegations at the IBO were invited to take part at the ceremonies, 22 representatives came for the opening and 5 for the closing ceremony and took the opportunity to greet the participants.

A few cultural performances livened up the ceremonies and presented traditional Swiss folklores with the Quatuor de Nendaz, Alphorn players from the Canton of Valais, Flag Thrower from Schmitten, Canton of Fribourg, Yodel Club Trub from the valley of Emmental, Canton of Bern and finally Nicolas Senn with the hammered dulcimer, Canton of Appenzell.

### 5.3.2 Excursions

The excursions were chosen in order to show different aspects of Switzerland, natural and cultural highlights offering some interesting insights. Both jury members and students enjoyed the following excursions:

- City of Bern, founded in 1191, a UNESCO World Cultural Heritage site
- Mount Niederhorn – Bern is close to the Alps and offers a breathtaking view of the mountains. Going up the Niederhorn allowed an insight in alpine vegetation and some animals. Through the clouds it also offered a beautiful view on the Lake of Thun, the surrounding mountains and the world famous mountain trio of the Swiss Alps, Eiger, Mönch and Jungfrau.
- Natural History Museum of Bern from the Burgergemeinde Bern, founded in the 17th century. It is home among other highlights of an astounding display of crystals. All participants had a special treat as they enjoyed dinner (for jury members) and lunch (for students) in the rooms of the Museum in the middle of the exhibits.

The students visited further:

- St. Beatus Caves with traces of six glacial periods
- Emmentaler Show Dairy where they could give a hand and produce their own fresh cheese which they would taste. Cheese making today and in old days should not have any more secrets for the youngsters by now.
- Dählhölzli Zoo which hosts especially northern-European animals and works according to the principle “more space for fewer animals”.
- Parliament building, seat of the Swiss government and parliament. All youngsters could – thanks to a special permission – sit down on the seats of the national councilors and were greeted by a representative of federal parliament.

On their part, the jury had special program points with:

- Swiss Open-Air Museum Ballenberg in the Bernese Oberland, where original, century old buildings from all over Switzerland have been rebuilt in a lovely traditional landscape. It also shows the traditional craftwork of times gone by.
- Optional visit of various museums, i.e. Alpine Museum, Bern Historical Museum, Botanical Garden, Museum of Fine Arts, Zentrum Paul Klee



**TOP** Swiss Night alphorn playing: who is able to produce a sound out of the alphorn?

**LEFT** Swiss Night wood carving: who carves the nicest cow?

**RIGHT** Swiss Night food: how to eat raclette?

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### 5.3.3 Educational Session

IBO offers the opportunity to improve biology education – a precept that has been reinforced in 2013 with the Educational Session that took place on Saturday morning at the initiative of Ryoichi Matsuda. The session was prepared by Mary Oliver (AU), Andrew Treharne (UK), Javier Fernandez Portal (ES) and Ryoichi Matsuda (JP) and was very well attended, despite all doubts that came up previously and the optional visit of different museums of Bern on the program at the same time.

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### 5.3.4 Evening Programs

#### Jury Reception

Adding an extra day to the jury session and hence changing the program for the jury had eventually some influence on the evening programs, as the traditional student/jury meeting could not be scheduled on Tuesday. Instead, and in order to introduce a break in the jury work, a special reception at the Natural History Museum from the Burgergemeinde Bern has been organized where the jury members could meet all scientists involved in the preparation of the exams.

#### Swiss Night

Due to the changes in the program as mentioned before, the first reunion between students and jury members was scheduled on Thursday night, after completing the theoretical exams. The so called Swiss Night took place in the former factory of the famous Swiss chocolate Toblerone, nowadays a building used by the university and known as Unitobler. As the jury made the decision on Wednesday to elongate each theoretical exam by 30 minutes and because some delay occurred at the beginning of the exams, the evening had to be rescheduled at the last minute. As expected, the students were very hungry and after a first rush on the buffet with Swiss specialties such as raclette (melted cheese) and Liechtenstein's "Käsknöpfle", the pleasures of that special night were duly sampled and appreciated by all.

This relaxed night was dedicated to "Swiss culture" on an interactive basis. Several opportunities were given to our guests to try not only food specialties but also test one's artistic, vocal or intellectual skills, or just to have fun.

The following workshops could be visited:

- Alphorn playing
- Yodeling
- Wood carving
- Swiss German speaking
- Chocolate molding
- Crossbow shooting

All workshops were very successful and the chocolate fountains were nearly raided! You could also hear many young or not so young voices tuning in with the special yodeling modulation of the voice late at night or trying to speak out the "barbarian" sounds of Bernese German – some found it easier than others.

#### Students' Evening Program

The center of most evening programs and of students' night life was certainly the common room. It was open whenever no other program was proposed by the organizers and, addition-

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ally, always after the students returned from other events. The students and team guides were free to meet, chat, play and stay up till the room was closed. The decision to close the room was made by the senior guides depending on the attendance. As the room was in a separate, uninhabited building across the street of the hotel, neither hotel guests nor neighbors were bothered by the sometimes quite vivid and noisy program.

Within the common room, students were free to decide what to do. However, mostly senior and chief guides had organized special programs which they carried out spontaneously depending on the crowd's mood. Thanks to our guides (most of them former participants themselves) this has proven to be a great solution. Hence, games were learned and played, little competitions and karaoke nights organized. The evening program was well appreciated by the students. As the answers in the questionnaire show, 85% of the students gave a positive feedback (see chapter 7).

During all nights, students were free to go to bed whenever they thought fit. A couple of team guides were always present in the reception of the hotels in case of questions or emergencies and to make sure that no student would use the computers situated in the lobby. They were present as well on the nearby tram stop to prevent the students from sneaking into town. When the common room was closed, the remaining students were accompanied to the hotel.

Find below a choice of the additional evening program that was set up for the students:

### **Ice Breakers, Monday:**

In order to break the ice and help the students to get over initial shyness, so called Ice Breakers were kindly organized by the "Unisport" (sports program of the University of Bern) and were carried out with the help of the team guides. In funny games that took place outdoors on a sport pitch close to the common room, participants were encouraged to interact and talk to other students, especially from other delegations. The games played were optional but were attended by a very high percentage of all participants (event though exams were scheduled for the next day).

### **Sports and Entertainment, Tuesday:**

Organized once more by "Unisport", the students could enjoy a diversion from their brain powered exams after the practical exams on Tuesday and spend some energy on sports. Again, and thanks to good weather, the program took place outside and was attended by the majority of all students. It was considered important by the organizers to counterbalance the intellectual strain and relieve the nervous tension inherent to the IBO with physical activities.

### **Bio Video Competition, Tuesday:**

The traditional Bio Video Competition took also place in 2013. As many as 10 delegations (highest number ever) have sent in their video in 2013, showing in their own creative way why they loved biology. Five out of them were selected in advance by the coordinators and shown to the students on Tuesday after the sports program for their final decision. The winner of the competition, team Switzerland and Liechtenstein, was announced on Saturday during the gala dinner.

### **Farewell Disco, Saturday:**

After the closing ceremony and the gala dinner, students returned to their hotels. From former participants we knew that during the nights after the exams and especially on the last night,

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many participants hardly sleep at all. Therefore, an open-ended farewell night including a disco and a DJ was organized in the common room and turned out to be – not unexpectedly – a success.

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## 5.4 Logistics and Infrastructure

### 5.4.1 Accommodation

Lacking a university campus with suitable student dormitories to house all participants, and given the relative small size of the city of Bern, finding appropriate accommodation for all guests was a difficult task. This was even more difficult as students and jury members needed to be separated during the main part of the week.

#### Students

Besides the scientific aspects, one of the main goals of the IBO is to promote the exchange between all participants. Therefore, the preferred student accommodation should house all students in one place, preferably with a large common room enabling social activities in the evenings. Many hotels in Bern were unable or unwilling to house 280 persons for 8 days (including team guides). Alternative solutions such as military dorms, civil protection shelters or several camp sites with bigger dorms (scouts, sports) were evaluated. Unfortunately, many were unable to house the desired number of people or had no satisfactory infrastructure (10 bed dorms or more; no manned kitchen; no common room...) or were too far away from Bern.

In the end, two hotels at the same place were chosen and could house all students and guides in double and three bed rooms which were simple but of a good standard, with private bathroom and TV. Unfortunately, they were not able to cater for all 280 guests simultaneously and had no common room big enough for this number of people. This problem was solved thanks to the curling center and adjacent restaurant across the street.

Although the wish to go back to the roots of the IBO is often heard from coordinators, meaning less luxurious accommodation for instance, quite a few students reported to have some problems. This affected mainly the three bed rooms, which were sometimes criticized for a lack of privacy as the rooms and bathrooms were rather small. Also, the rooms often had a double bed instead of two separate beds (equipped always with two separate blankets, after initial problems caused by the hotel), lacked an alarm clock and, in many cases, had no lockable shower room. Also, no air-condition system was available (but air-cons are in general rare and also not necessary in Switzerland in any case). These negative aspects are reflected in the score obtained for the accommodation in the students questionnaire, with a low average of 3.27 (the lowest score reached, see chapter 7).

Rooms were shared wherever possible with students from the same delegation and always of the same gender. In some cases, youngsters of different delegations had to be mixed, giving the students another opportunity to get to know each other.

#### Jury

Having booked the only hotels available with sufficient capacities for more than 200 people, a different solution for all jury members and observers had to be found. Therefore, all hotels within 10 minutes walking distance to the jury room (Kursaal) were contacted. They were conveniently located along the tramway line stopping in front of the Kursaal. A combination



of six different hotels was chosen in the end, the majority of which was located in the old town of Bern. With such a number of hotels, their standards differed some, but all hotels were at least of a middle class category.

The regular room was a double room which was shared with people of the same gender (except otherwise requested) and preferentially from the same delegation. Each jury member or observer had the possibility to name preferred roommates during online registration which were, wherever possible, taken into account.

Single rooms were available upon request and for an extra fee of CHF 400 per person. In the end, a total of 45 single rooms were booked. Single rooms were only available until June 15, as at one point reservations needed to be definitively fixed. Rooms booked in excess were charged to a certain extent (or even completely one week before the IBO started).

Room Category	Number of Rooms
Single Rooms	45
Double Rooms	86

**TABLE 5.2** Number of single and double rooms booked.

Using six different hotels caused also some problems: The entire time used for hotel evaluation and the booking process summed up and hence obviously caused a higher workload. Further, reaching all guests (i.e. to communicate changes of locations or times at short notice) was quite complicated.

### **Jury Budget**

In response to several requests and in order to help delegations with a tight budget to bring more than the regular two jury members per delegation, the category “Jury Budget” was implemented. The budget rate was CHF 500 cheaper than the regular rate and arose because these guests would have stayed in dormitory beds of a youth hostel. This budget rate was also open to any observer.

However, only two participants chose this option. As they were of different gender, not even a double room could be booked in the hostel. As these guests should not be sharing a room with total strangers, the budget option was cancelled and the two participants were accommodated in the same hotels as the rest of their delegation.

### **Hotels for Early Arrivals**

For all participants arriving before July 14, hotels in Bern and Zurich (close to the airport) were arranged offering special rates for all those who mentioned the International Biology Olympiad while booking.

### **Volunteers**

Team guides stayed in the same hotels as their students. The door of each guide’s room was labeled to help students find their corresponding team guide. Additionally, team guide rooms were put as close as possible to their corresponding delegations, ensuring that on each floor of the hotel at least one team guide room was to be found.

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All other volunteers were housed in the youth hostel of Bern, with 2 to 5 persons per room. Although volunteers with the same jobs were put in the same rooms, they nevertheless often had different working schedules (night shifts; early rises...) causing unwanted disturbance for their roommates. A maximum of 2 persons per room would have been preferable, taking into account the fact that most volunteers had long shifts and only few sleeping hours.

### 5.4.2 Jury Room

The success of the IBO with an ever growing number of delegations each year as well as the technical progress logically have consequences on the demands on infrastructure. Needs and expectations about the technical and logistics facilities and requirements for the jury room grow and hence, finding a suitable location for the jury sessions was a difficult task. Some of the demands that needed to be fulfilled were:

- Enough working space for about 220 people
- Easily reachable from all jury hotels
- Room and facilities to serve lunch and dinner as well as to offer constant provision of snacks and drinks, also through the night
- Power supply for 220 laptops and 6 printers
- Sufficiently strong internet connection for all persons (the newly offered translation tool was linked to a data base and set up in an internet browser)
- Visual and acoustic technical infrastructure sufficient for 220 persons
- Technical support during the entire period (also with respect to laptops and computer systems from 64 different countries)

After evaluating several options, only two possibilities were left. Either the entire infrastructure could be set up by the organizers in an exhibition hall (potentially a little bit cheaper, but related to a high amount of manpower and more coordinating/logistics problems) or a professional conference provider could be hired. In the end, the latter solution was chosen by booking a hall in the Kursaal Bern. This guaranteed a professional infrastructure with technical support, all in-house, including catering; a great relief for the IBO 2013 organizing team and worth every penny spent. It turned out to be a very much appreciated venue by all jury members. Due to the complexity of the jury work and the number of persons attending, it was not possible to guarantee a smooth process of the session without a specific, costly and complex infrastructure, at least not in a country such as Switzerland.

Each delegation was provided with a laptop (English keyboards) with which they could use the equally provided printers. Additionally, a USB stick and a hard copy of the practical exams in either English, Russian or both were distributed.

The power sockets were changed to the frequently used European Schuko plugs instead of the unique Swiss power sockets. Adapters were provided by the technical support company upon request.

A Wi-Fi internet connection was available throughout the entire period of the jury session.



**TOP** Swiss Parliament: students take the seats of the national councilors.

**BOTTOM** Discovering the UNESCO World Cultural Heritage site of Bern.

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Lacking a source for massage chairs (a much appreciated innovation provided at the IBO 2012 in Singapore) relaxation / yoga sessions were offered on Monday and Wednesday for all jury members during the afternoon break.

The seating arrangements were done with reference to preferences as stated during the IBO 2012 in Singapore and according to languages, see appendix 8.3.3. Example for language collaboration: Switzerland translates usually in German and French and therefore works together with the other French and German speaking delegations, hence with Belgium, Germany and Liechtenstein. Belgium on the other hand is equally bilingual (French and Flemish) and works together with the Netherlands. These delegations were therefore seated next to each other.

### 5.4.3 Food and Beverage

Nowadays, Swiss cuisine bears witness of many regional influences, especially from Switzerland's neighbors Italy, France and Germany, but still features many specific local dishes. A focus on traditional Swiss food was set during the "Swiss Night" on Thursday, July 18. For all other meals of the IBO week, catering partners were instructed to choose rather pan-European dishes commonly eaten in modernday Switzerland than to concentrate entirely on traditional Swiss food.

#### Special Diets

All guests were asked to inform the organizers during the online registration about their needs for special diets. The list, as shown in TABLE 5.3, was forwarded to all catering partners to ensure that all participants' needs could be met. Additionally, all caterers were asked to label all dishes in English and to clearly state especially whether meat was used, and if so, of which origin (i.e. chicken or beef). Unfortunately, the labeling was not done by all partners with the same accuracy, making it in some cases difficult for guests with special diets to identify suitable meals.

Vegetarian / halal	80
No pork	45
No pork or beef	5
No fish / sea food	5
Vegan	2
Wheat allergy	2
Lactose intolerance	2
Other allergies	3

**TABLE 5.3** Special diets of all participants (including volunteers and organizers) based on data provided during online registration.

#### Halal

Being unable to organize all meat to respect Islamic dietary laws, we informed all catering partners that at least no pork or pork sourced products should be used during the preparation of any food. Additionally, all caterers were asked not to use any alcohol when preparing any dishes, guaranteeing at least all vegetarian dishes to be halal.

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## **Ramadan**

Ramadan is the ninth month of the Islamic calendar and for many Muslims a month of fasting during the day time hours. As the entire IBO 2013 was taking place during Ramadan, all guests were asked during online registration to indicate whether they will observe Ramadan and if so, to submit their precise fasting times as these may vary.

Special dinners and breakfasts were organized for all 11 persons (including one volunteer) that registered, with breakfast being ready before sunrise (provided in the evening of the previous day) and dinner being served after sunset.

## **Beverages / Water**

Switzerland is known as the water tower of Europe, and furthermore, Bern is known as the “City of Fountains”. To reflect this fact, all participants were offered a reusable bottle and were informed that all tap water and almost all water from fountains (except otherwise indicated) in Switzerland are of high quality and can be drunk without concern. All guests were kindly asked to refill their bottles and hence to help reduce the amount spent on pricey and mostly equal (in terms of quality, taste and mineral content) bottled water. Information on tap water was available on the website, in the program booklet and in one edition of the IBO newsletter mIBO. Additionally, all guides were instructed to remind especially the students to fill their water bottle every morning before leaving their hotel and to promote the use of tap water.

## **Alcohol**

For students, alcoholic beverages were forbidden throughout the week with exception of the gala dinner after the closing ceremony. There, consumption was left to the responsibility of the participants and their accompanying jury members.

Jury members were free to consume alcohol at their own discretion. Alcoholic beverages were only offered during the reception in the Natural History Museum of the Burgergemeinde Bern on Tuesday, July 16 as well as during the gala dinner on Saturday, July 20.

As mentioned before, no alcohol was used in the preparation of any dishes for neither jury nor students.

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### **5.4.4 Transport**

Every host of an IBO has to organize and finance all program related transports for all guests, including the transfers to and from the train station and / or airport of the city the IBO is held in (see IBO Rules and Guidelines for the host country). As the local, though international, Bern-Belp Airport offers only a limited numbers of flight to mainly European destinations, the organizers decided to extend the shuttle services to Switzerland’s biggest airport in Zurich. These shuttles on July 14 and 21 were free of charge for all guests. During the week, IBO transfers were carried out either by hired busses, public transport or wherever acceptable, on foot. The transport system received high marks in the evaluation by both students and jury members (over 90% very positive), a good result also related to the use of public transport system.

### **Arrivals**

Pick-up service to the IBO registration site in Bern was offered from three locations on July 14: from Bern-Belp and Zurich Airport as well as the Bern main train station. In addition, guests were free to reach the registration site on their own. All delegations were asked to

inform us during online registration about their desired pick-up location (see TABLE 5.4 and chapter 5.7.2).

Pick-up location	Nr. of delegations	Nr. of persons
Zurich Airport	42	290
Bern Airport	1	6
Bern Train Station	11	71
IBO Registration Site	8	39

**TABLE 5.4** Pick-up locations chosen by all guests that provided the relevant information.

All delegations also had to inform us when and how they would arrive in Switzerland. According to the information provided by 406 guests and as shown in TABLE 5.5, 47.8% of all participants arrived on July 14 and hence on the day the IBO 2013 started.

One delegation arriving by plane late in the evening of July 14 was unfortunately not able to reach Bern punctually for the opening ceremony but joined the international community for the welcoming dinner thereafter, while one jury member of another delegation arrived one day later, on Monday July 15.

All guests that arrived earlier than July 14 generated an extra 374 nights spend in Switzerland.

Arrival day	Days before the IBO 2013	Total number of persons
08.07.2013	6	2
09.07.2013	5	8
10.07.2013	4	2
11.07.2013	3	39
12.07.2013	2	37
13.07.2013	1	123
14.07.2013	0	194
15.07.2013	-1	1

**TABLE 5.5** Arrivals of all guests that provided the relevant information.

Means of transport	Nr. of delegations	Nr. of persons
Plane	55	364
Train	5	31
Car	2	8
Bike	1	3

**TABLE 5.6** Means of transportation chosen to travel to Switzerland of all guests that provided the relevant information.

## Transfers during the IBO Week

### Public Transport:

Given the size of the City of Bern and its easy-to-use, dense and high frequented public transport system, many transfers were done by tram or bus. For each guest, a 10 day-pass was provided, and, in the case of jury members, observers and volunteers, was handed to each person upon registration. This allowed all of them free transport in the entire city also for transports that were not part of the IBO program. The students' passes were kept by the team guides in charge so that uncontrolled and unauthorized transports without a team guide could be limited.

### Hired Busses:

Busses from a public transport company (PostBus) were hired for all excursions to locations outside the City of Bern, the arrival and departure shuttles and all exam related transfers. In each bus and during each transfer, at least one but usually two volunteers were accompanying and caring for all guests.

On excursions, students were split into groups and assigned to one specific bus labeled with an individual logo. The logo was put in the badges of each student to make the assignment clear for both students and team guide. With this option, team guides could easily spot whether a student was amiss after a sight had been visited. Understandably, some students would have wished to change their bus during excursions to meet other participants but making it henceforth nearly impossible for the team guides to keep an overview on all participants. This was hence not accepted.

### Departures:

Similar to the pick-ups on the arrival day, guests were also offered drop-off services again to the Bern-Belp and Zurich Airports. Additionally, students were brought to the Bern main train station or the jury hotel upon request. Again, and even though all delegations were even reminded in the jury session during the IBO itself to submit their departure information online, not all delegations have informed us about their plans (see TABLE 5.7 and chapter chapter 5.7.2).

Drop-off location	Nr. of delegations	Nr. of persons
No shuttle service needed <sup>1</sup>	20	121
Shuttle to Zurich Airport	39	276
Shuttle to Bern Airport	2	18

**TABLE 5.7** Drop-off shuttle options chosen on Sunday July 21, 2013.

<sup>1</sup>Including delegations where students were brought by guides to their jury's hotel or to the train station to meet jury members.

Further, all delegations had to inform us when and how they will leave Switzerland. According to the information provided online by 58 out of 64 delegations representing a total of 411 guests, and as shown in TABLE 5.8, 90.3% of all participants left on July 21 or even before the IBO 2013 officially ended.

2 jury members left on Thursday, July 18. Additionally, 1 student had to leave on Friday, July 19. As she was a medal winner, one of her jury members replaced her during the closing ceremony and received the medal in her stead.

3 delegations left already on Saturday, 1 before and 2 just after the closing ceremony.

Departure day	Days after the IBO 2013	Total number of persons
18.07.2013	-3	2
19.07.2013	-2	1
20.07.2013	-1	21
21.07.2013	0	347
22.07.2013	1	18
23.07.2013	2	15
24.07.2013	3	7

**TABLE 5.8** Departures of all guests that provided the relevant information.

Means of transport	Nr. of delegations	Nr. of persons
Plane	47	326
Train	11	64
Car	4	21
Bike	0	0

**TABLE 5.9** Means of transportation chosen to leave Switzerland of all guests that provided the relevant information.





**TOP** All volunteers deserved the big applause they received from the audience during the gala dinner.

**LEFT** Volunteers first aid schooling.

**RIGHT** Volunteers at work, correcting the exams.

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## 5.5 Volunteers

Volunteers are at the core of the IBO, maybe even more so in Switzerland. The National Biology Olympiad is based exclusively on voluntary work; volunteers initiated the IBO 2013 and invested time and knowledge in order to organize the IBO. Their huge dedication had a deep impact on the IBO 2013, not only on the organization but also on the atmosphere that reigned during this intensive week.

As volunteers, we call persons who worked for the IBO without salary, in their free time, i.e. besides their regular job or studies, taking time off during the IBO or even giving up their vacation to help out at the IBO.

The usual area of work of volunteers at the IBO is to look after students and jury members. However, at the IBO 2013, they were also deeply involved in many aspects of the preparation, mainly on the scientific part of the organization. Volunteers were at work as

- team guides (37)
- jury guides (8)
- scientific assistants (14)
- all-rounders (7)
- journalists and photographers (4)

IBO 2013 worked with a comparatively small number of volunteers for two reasons:

First, we had a very precise profile of persons in mind, putting the priority on individuals having affinities with the IBO and who would therefore be very dedicated and able to take over more responsibilities.

Second, we did not wish to have too many volunteers who would in the end just “hang around” and which would be more difficult to coordinate. Underemployed volunteers would be frustrated, hinder a smooth running of the IBO and burden the organization. Also, it is not very easy to recruit “good” volunteers, so we decided on a limited number of persons.

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### 5.5.1 Recruitment

As the organizing team was very small, it was of the utmost importance that it could rely on trustworthy, proactive and autonomous guides during the IBO. Therefore, special attention was given to the recruitment of the volunteers. High priority was set on the volunteers of the Swiss Biology Olympiad and former participants of national or international Olympiads, who themselves recruited persons of their entourage. We also asked members of other Scientific Olympiads (Informatics, Chemistry, Physics and Mathematics) to help out.

All interested persons had to fill out the application form on the website where they found more information about the IBO and also the qualification requirements. All volunteers had to be Swiss citizens or residents for legal reasons. Furthermore, they had to master at least one of the national languages besides English and be familiar with the Swiss culture and way of life. They also had the possibility to inform us about preferences concerning their assignment (foreign language, teams they'd like to be in charge of etc.) which we tried to take into account whenever possible.

Our scientific assistants were all scientists and/or experienced IBO people, so that they worked purposefully for the scientific project management.

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The volunteers were offered free board and lodgings. Their expenses were of course taken over by the organization and they received the same gift-package as all our guests. At the end of the IBO, all of them received a personal work certificate in recognition of their commitment.

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### **5.5.2 Team Guides**

As we mostly had Olympiads-experienced guides, the organizers made the decision to give each of them the responsibility for two teams, i.e. up to 8 students, instead of only one delegation. The teams were put together mostly randomly. Every team guide was also deputy team guide for another colleague and had to step in in special circumstances. Team guides were hierarchically organized, 5 senior guides were responsible for 5-6 team guides each. All senior guides reported to the chief guide who himself was also in charge of team guides. This turned out to be a heavy work load for the chief as he also had organizational duties. Retrospectively, this organization worked out well but it would have been better to have an additional senior guide to ease the chief's work load.

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### **5.5.3 Jury Guides**

Here again, our point of view was that the jury members were all independent adults, mostly used to travel, so that we felt that besides a close support during the sessions, basic support would be enough, especially at the beginning of the week and till one found the venues easily. Bern is of course, thanks to its small size, very easy to get along with. Besides, the management was reachable at all time in the office or by phone. Further, the guides accompanied the jury on their excursions, took over an intensive shift for the printing of the practical exams and helped in various other tasks (e.g. during both ceremonies and the set-up of the theoretical exams).

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### **5.5.4 Scientific Assistants**

The scientific assistants also were recruited among former participants of an Olympiad and were all "professionals" in their fields of action. Besides, 3 persons were responsible for the practical exams. One out of them took the overall responsibility for the 11 scientific assistants that would prepare and oversee the exams (with the assistance of team guides). Additionally, 4 persons were responsible of the IT.

All of them were under the supervision of the scientific project manager and instructed by him. Some of them were deeply committed and invested many hours well in advance to the IBO.

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### **5.5.5 All-rounders**

As stated by the name, these seven were our aces during the IBO. They were our reserve volunteers and jokers for any unforeseen situation. They had to be very flexible, be able to meet high demands and step in for whatever problem had to be solved. These persons turned out to be much demanded and extremely helpful. They were set on very different tasks, for example as nurse, messenger, jury guides and more.

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### **5.5.6 Media Team**

The media team was recruited among friends of former Biology Olympiads participants or acquaintances. We were lucky to find skilled people, one of them even a professional journalist, ready to pick up this challenge in their free time. Three of them concentrated mainly on writing, whereas the fourth member was an excellent amateur photographer. But tasks were

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not strictly separated. They met quite early in the year to distribute the work and prepare all editions. More about it can be found in chapter 5.6.5.

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### **5.5.7 Training**

The volunteers' training took place mainly in the 2 days previous to the IBO and was tailor made for all groups. Chief and senior team guides were schooled on two additional days in June, one in order to make all students' excursions and the second for more specific information. All volunteers received a few weeks before the IBO a documentation containing general information about the IBO, the IBO 2013, background information about Switzerland, but also about the rules valid during the IBO and some specific information about their responsibilities and basic first aid knowledge. They were asked to study this paper in advance so that we could concentrate on the most important items during the schooling and answer all questions. Team guides arrived at noon on Friday July 12 and went first to reconnoiter all venues for the IBO in Bern. The evening was dedicated to packing the gift bags all together, giving a good opportunity to get to know each other and have fun.

On Saturday morning, all volunteers had arrived and received basic instructions in order to give them an overview of the IBO in all respects, pointing out especially the rules set up by the organizers and giving all volunteers a thorough schooling in first aid. A special point was made about the contact with media, as we expected some interest, particularly for interviews with participants, and wished to make sure that the students would be treated correctly.

On Saturday afternoon, the volunteers were separated according to their assignments and schooled specifically on their tasks and responsibilities.

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### **5.5.8 Comment**

The overall amount of guides was enough for the daily routine at most times. At some points during the week, when many things happened together a few more volunteers at hand would have been an advantage from the point of view of the organizers. Nevertheless, at any time and thanks to the over average dedication of all, all duties and work could be dealt with satisfactorily. The "all-rounders" proved out to be an indisputable asset of our organization. The evaluation of the team guides through the students brought impressive scores with an overwhelming average of 4.81 (97.7% of marks 4 and 5) for their care and 4.71 (95.3% of 4 to 5) for their competences, the best marks of all.

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## 5.6 Media and PR

From the start, more was expected from the IBO 2013 in Switzerland than just to be an attractive competition for youngsters interested in biology. Indeed, hopes were put in the organization of the IBO in Switzerland to wake up the interest and enlarge the awareness among the population and also promote scientific Olympiads as a successful and attractive way to support young scientists in the educational system. Therefore special attention was given to public relations and, as far as possible, media coverage. The website was of course crucial to the communication concept.

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### 5.6.1 [www.ibo2013.org](http://www.ibo2013.org)

We chose to carry on with the established naming of the website, without any additional terms, in order to facilitate the worldwide identification of the website. This address is also the most logical for inexperienced users.

Many requirements are made to the website, even more so in Switzerland as quite different target groups had to be satisfied. First of all, the website had to give participants all required information and to offer a platform to register and meet all requirements for participation online. Second, any interested person should find basic information about the IBO easily and then, the website was an important instrument to reach our goal to make the Olympiads better known in Switzerland and later on as a supplier of background information for the media, with a special dossier.

Therefore, the handling had to be user friendly, of easy access, all contents except for the login part (only English) available in at least German and French besides English as they are the most widely spoken languages in Switzerland (ideally, Italian would have been added but this was not possible for time and financial reasons). As finances were scarce and competence was at hand, the entire website was created in-house, taking over the logo as a golden thread. We also refrained from integrating animations, films or others on the website as not all users have highcapacity computers and internet connections. Verbs were mostly used as menu titles to invite people to be active. Last but not least, the website was a way of informing relatives who stayed home, about what happened at the IBO. Therefore, the daily newsletter mIBO and the daily video blog were prominently uploaded every day.

The first general pages about IBO, the IBO 2013 and Switzerland were uploaded at the beginning of 2012, i.e. 1½ year before the IBO. On and on, more pages were added, as for example information about travelling to Switzerland, the possibility to sign in as a volunteer and much more. Special attention was of course set on preparing the login section with all forms to be filled out. The website was programmed to be able to generate automatic mails to those from whom information was missing. As a new fee system was implemented, the program also immediately gave a feedback about the costs and status of registration to all delegations. All information received was immediately integrated in our planning which could be kept up to date.

The website received many compliments about its attractiveness and handiness (see chapter 7). It was very well visited during the last one and a half year, starting slowly but gaining more interest as the IBO drew nearer. Of course, as all the registration procedure was made online, many visits were due to administrative tasks. Nevertheless, the number of unique visitors shows that the site was also visited by others. The amount of visits on [www.ibo2013.org](http://www.ibo2013.org) increased constantly each month and reached a maximum in July 2013, especially during the IBO

week as can be expected. On the two days following the closing ceremony, 5350, respectively 4205 persons visited the website, probably to see the results and have a look at the last news!

Nevertheless, the number of clicks does not say much about the quality of the visit. Still we can assume that many people visited the site for a short period of time out of curiosity and looked for information. Besides, it may be of some interest to consider which pages were mostly looked at. Most visitors entered and exited the site through the homepage – quite a lot of them staying probably just a few seconds on it. 13.5% visitors stayed 2 to 15 minutes, while 8.4% stayed up to one hour on the site. The page with the highest amount of visits is the one with the portraits of the delegation members (87602 visits) followed by the page IBO 2013 (50731 visits). Quite a few visitors (14622) also entered directly through the page IBO 2013, leading in a straight line to the event.

The website will be kept online for the next years. It contains information about the exam results. The statistical analysis of the exams and the final report will be uploaded as soon as available.

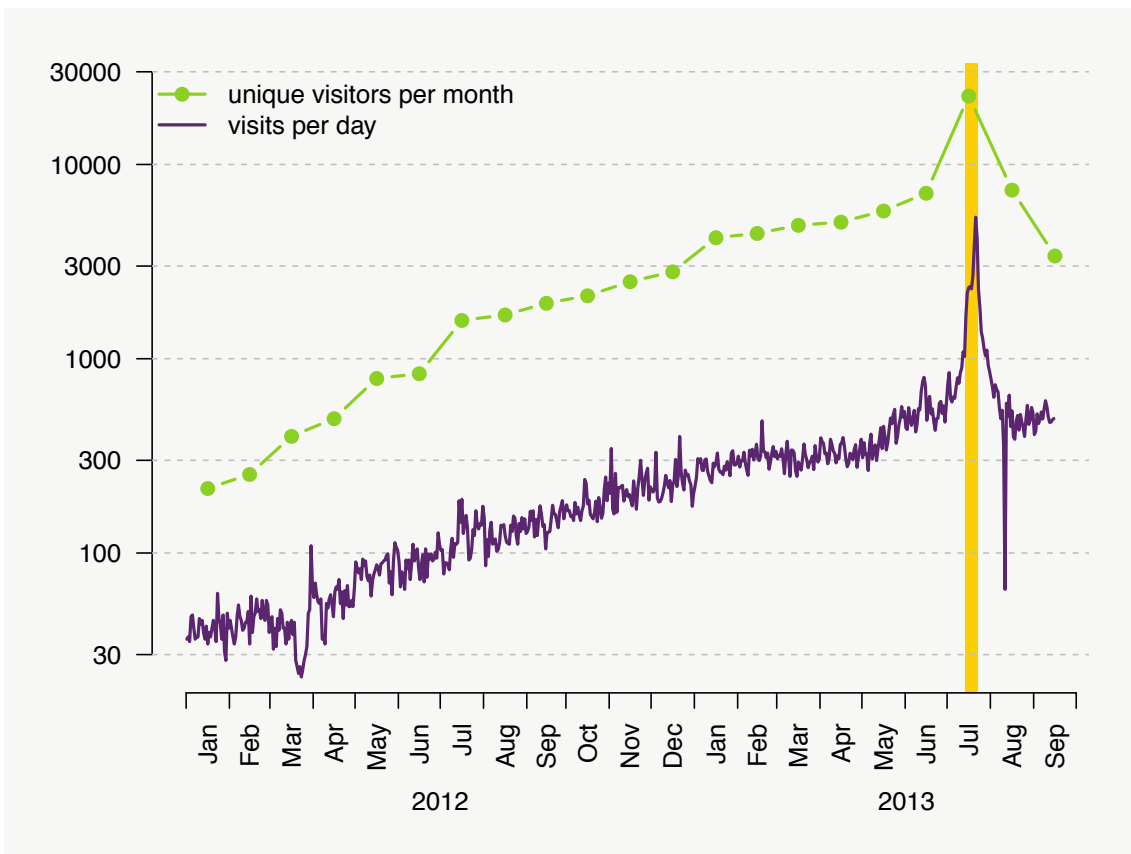


CHART 5.2 Number of visits on www.ibo2013.org Jan 2012 – Sept 2013.

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## 5.6.2 [www.facebook.com/ibo2013](http://www.facebook.com/ibo2013)

Facebook is one of the most common social media networks used especially by younger users. [www.facebook.com/ibo2013](http://www.facebook.com/ibo2013) was set up to provide up to date information for all interested people, be they participants, friends or parents. Also, an online platform for future networking of our students was established with the help of which they will remain connected even years after the IBO 2013. Besides updates, regular news, photos and videos, pictures of the IBO King's Cup were posted each month, showing the Cup in a typical Swiss or Bernese setting matching the season at the time.

Our Facebook community grew over the months and was especially active when the IBO was over. A total of 1'200 users liked our site by the middle of September 2013 (with 668 by July 14 and 892 by July 21). Via these users' friends, up to 6'000 persons could be reached daily during the IBO week with up to 30'000 impressions shown (compared to an average of around 160 daily reached persons and 760 impressions from May to June 2013).

Facebook is certainly an important means of communication nowadays, especially for young people and should be taken over systematically by the IBO. However, it must be updated and attended to regularly, which necessitates enough resources.

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## 5.6.3 Media

As mentioned above, an important aspect of the IBO in Switzerland was to sensitize the public and the representatives of the educational system about the Olympiads. Therefore, priority was set on achieving large media coverage. Together with the communication department of the University of Bern, a media concept was developed addressing national and local media, print, radio and TV, specifically also the education departments of the cantons and many more. Of course, one has to stay realistic about the importance of this event in the public eye, at least in Switzerland. Scientific Olympiads are unfortunately not yet well known and are not considered as a priority or high profile information by the media.

Information about the upcoming IBO 2013 started to be published as early as one year before, as secondary information in press releases related to all scientific Olympiads with Swiss participation. This was done via the press releases the Association of Swiss Scientific Olympiads ASSO sent out after each Scientific Olympiad. Although the interest about the IBO was very low at the beginning, a first success was realized in October 2012 with an article in Bern's leading newspaper. Slowly, some further comments were published here and there and a certain interest started to show locally, especially with the results of the Swiss Biology Olympiad in April 2013. A short interview was even published in the main commuter newspaper of the Bern area, reaching ten thousands of readers.

Furthermore, a media conference was scheduled a few weeks before the event, on June 27, 2013 and many journalists were invited. Although very few journalists attended this presentation, quite a media presence was achieved as a result, with newspapers articles, an interview on the local radio and a background article in a professional review.

Journalists were thereafter again contacted with a proposal to meet students during the IBO, of course only upon notice, as the possibilities were limited and requests had to be coordinated by the project management. Until the IBO, the situation remained quite calm and expectations about media coverage were modest. This turned out to be a wrong conclusion as a strong interest came up in the last minute during the IBO, especially on Tuesday, day of the practical

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exams. All of a sudden many journalists expressed their wish to come, see the youngsters in the laboratories and make interviews. Although this turned out to be quite a challenge, we managed to satisfy all demands while still giving the students all the rest and relaxing they needed on this stressful day. The biggest success – also we didn't dare hope for – was the coverage by the SRF (Swiss German TV – the biggest in Switzerland) for the most popular program, i.e. the main evening news. This report was then also broadcasted at noon and night news. Moreover, the IBO 2013 was covered by regional TV, local radio and some leading newspapers in Switzerland.

Around 130 mentions – nationwide and locally – were achieved in various media channels, i.e. papers, radio, TV and web. A certain echo could also be registered on the international level for example the German Radio ARD which made a special program about the Biology Olympiads, and mostly about the results achieved by their own delegation. Of course, not all publications could be monitored. A certain disappointment resulted concerning the coverage in other linguistic regions of Switzerland than German, although all information was published both in French and German. Only a few articles or other contributions were made in the Suisse Romande and Ticino, a result that wasn't really surprising but still is disappointing. But altogether, we consider the media coverage as a success.

In Appendix 8.1.2 you will find an overview of the media contributions and some chosen examples.

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#### **5.6.4 Video**

The decision to have a video team was made on short notice as we did not know for a long time whether there would be enough money for it. It was the case at the beginning of 2013 and a semi-professional production company was chosen for this task. The person in charge had already some knowledge about the IBO as he accompanied the Swiss delegation to Japan 2009 to shoot a movie for the launch of the IBO 2013 in Switzerland. The production team consisted of four members, all doing it part-time as their passion, some of them still studying at university.

As mentioned before, the IBO 2013 chose not only to make a video of the whole week, but also to produce seven short daily videos, so-called video blogs. They were not expected to cover all happenings of one day, but rather to concentrate upon giving an emotional testimony. They gave an opportunity to get an insight of the IBO to all those who couldn't participate in the IBO, for instance parents, friends, teachers, journalists.

Many hours of film were shot and had to be viewed every night to choose the best images, before cutting them into a short video. But after each nearly sleepless night, a blog was ready to be uploaded on the internet, the links given on our website and on Facebook.

The work for the video of the week was of course done at the same time but with the assignment to give an overall view upon the week, covering both the jury and the students' program. The final version could only be cut after the IBO in order to include the closing ceremony, but a preliminary version was shown at the ceremony, covering all days but the last.

The video blog received an excellent feedback according to the evaluation, although only the jury members were asked about it as students did not get the opportunity to view them before Thursday evening (no internet access allowed). With an average score of 4.26 and nearly 85% of the answers marked with a 4 or a 5, the blogs were very appreciated by the jury, a very





Friday: a busy day for students with, among others, "Biology around the World: Meet our Guests" on the Bundesplatz.

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satisfying result. On the net, all videos were clicked an average of over 2200 times, although day one achieved the highest score with over 3300 clicks, quite a satisfying result. All videos can be found in appendix 8.1.3 and 8.1.4.

### **5.6.5 mIBO Newsletter**

IBO 2013 carried on with the tradition of the daily edited newspaper. Our media team chose to name it mIBO with reference to the messenger RNA (mRNA) molecule, as a transmitter of information about Switzerland and the IBO, with pictures, texts and more.

Eight editions of four pages were edited, edition one waiting for the guests on their arrival and welcoming them to Switzerland while edition 8 bid them goodbye on the departure day. A total of four volunteers wrote the texts, took the pictures, finalized the layout and finally printed and folded the messenger IBO to make sure the newspaper could be distributed by bike courier to our guests as early as at 7 o'clock every morning. All editions were also uploaded on the IBO 2013 website and on Facebook and can be found in appendix 8.1.6.

The mIBO team met for the first time in March 2013. They did a brainstorming about possible topics; the decision was taken about the name of the IBO newsletter and the responsibilities distributed among the members of the team according to their skills. One person was chosen as chief editor who would coordinate all the work and make the final decisions. Possible layouts that were drafted by a graphic designer were assessed and a choice made. Furthermore, the content of the newsletter was defined and possible topics were discussed, tasks given to fulfill. A second meeting took place in May.

The idea of all this preparatory work was to finalize the layout of every edition as far as possible so that during the IBO 2013, the team could concentrate on covering the happenings of the days. Previous to the IBO, a master plan was made according to the IBO schedule, defining who had to be where and at what time.

mIBO received a relatively good feedback according to the evaluation, although inexplicably only the jury was asked about it (an unintended oversight). Over 68% of the jury gave a 4 or a 5, i.e. over two thirds of the jury members considered them to be interesting or even very interesting, still a satisfying result.

### **5.6.6 „Biology around the World: Meet our Guests“**

As mentioned before, the organizers wanted to use the IBO 2013 to increase awareness of the IBO in the public and get some coverage by the media. A special students' event was therefore planned for Friday afternoon. The parliament square in Bern (Bundesplatz) in front of the Federal Palace was booked to be the site of a special and colorful event that should raise the curiosity of the media and passers-by. The organization of this event was delegated to Science et Cité, a Swiss organization dedicated to foster the dialog between science and society because the IBO 2013 team lacked the human resources to do it by itself. Together with Kathrin Bigler, a performance artist, a flash mob was planned in the city of Bern. Students would start from various places and move according to a special choreography to meet on the Bundesplatz where music, drinks and ice-creams were awaiting them. To underscore the "Biology around the World" aspect, all students were asked to bring a biology book, an item from their country related to biology and send in a picture of their biology teacher in advance to be printed, all of which was then presented on the Bundesplatz. This led to an exhibition on biology under colorful umbrellas. The students enjoyed the opportunity given to them to relax and have fun,

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their experience made even better thanks to the fountains on the Bundesplatz which allowed some refreshment on this hot day. Also, the youngsters got carried away by a rock band (by courtesy of one of our financing partners) playing on the parliament square.

The public was addressed in two ways. First, by especially instructed young persons who interviewed passers-by about their own experience at school with biology before the arrival of the IBO participants. All those questionnaires, 84 in total, were then hung up on clotheslines set on the Bundesplatz. Second, the flash mob with all the youngsters in lab coats moving through the city was quite intriguing for the public. The media were also informed about the event and several journalists reported about it at some point during the day.

Although the echo in media and public was not fully satisfying and the event seemed to have been perceived by the public as an insider event, it still had some output and most importantly was a lot of fun for students as can be seen on the daily blog of Friday July 19, 2013.

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### **5.6.7 Conclusions**

All in all, we can consider that the IBO was a success considering the media coverage. Of course, not all activities received as much attention as we could have wished for; nevertheless, the result is more than satisfying. A first step was made to raise the public awareness for the Olympiads. This will have to be established with continuous communication measures and hopefully further positive reports about Swiss participants at Scientific Olympiads.

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## 5.7 Registration and Administration

### 5.7.1 Invitations

#### Preliminary Contact

A preliminary email was sent on November 23, 2012 to all coordinators of the 64 official IBO members listed on the website of the Coordinating Center in Prague. We asked them to login to our website and to indicate to whom the official invitation letter should be sent, giving the option to either add additional email addresses and / or post addresses for hard copy letters.

#### Invitation Letters

The official invitation letters were sent on December 12, 2012 by email and in 21 cases as paper copies. They contained also the delegation's specific login information to the registration system on our website, information on the new graded fees system, the Coordinators Center (CC) fees, a reminder for the declaration forms needed of all students, instructions on how to submit test questions as well as some further information (video competition, further activities and our Facebook website). The IBO 2013 website gave all these and more information in either the public or the login section.

Two delegations, France and Ireland, informed us after the receipt of the invitation letters that they would not participate in the current IBO, but might participate again in future years.

#### Additional Invitation Letters

Even though all delegations were asked to provide us with all addresses already in November, extra copies of the official invitation letters, mainly paper ones, had to be produced for 12 delegations during the coming months. Whilst the initial process of sending out the letters was an automated mass mailing, each of these additional letters needed to be produced manually.

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### 5.7.2 Online Registration

For many important steps of the organization (such as budgeting, booking hotels, planning excursions etc.) a good estimate of the number of participants is needed as early as possible. In order to achieve this, we implemented a graded fees system, offering the lowest participation fee only to those who register early while hoping that this would be an incentive for delegations to fulfill each registration step on time.

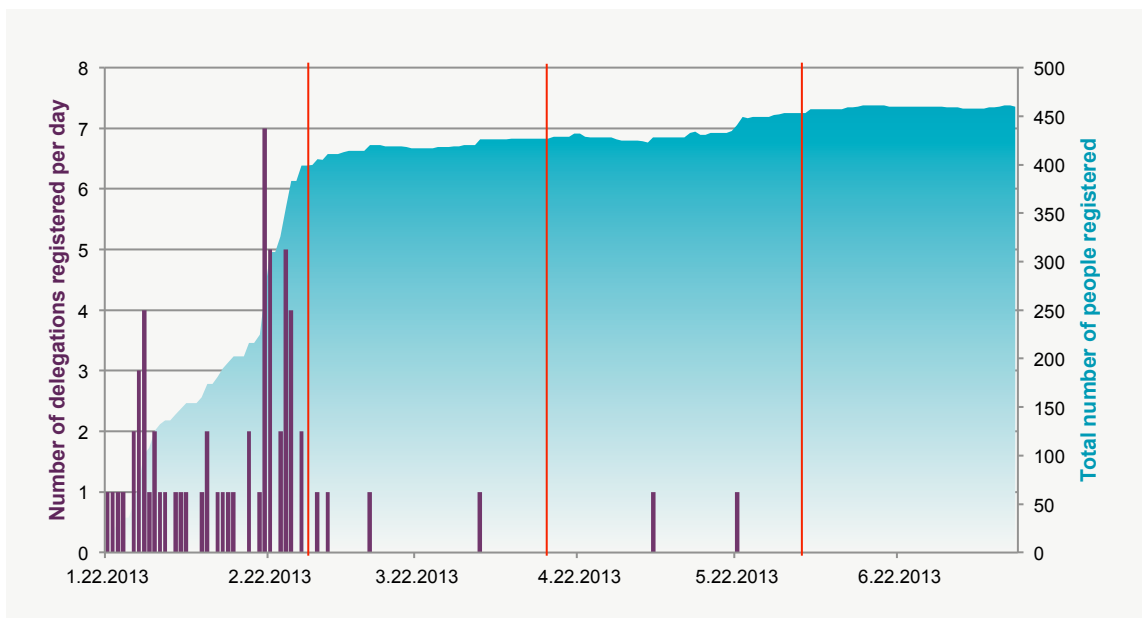
As the names of the participants are often not known until some months or weeks before the IBO starts, we asked all delegations to register only the number of people (not the names) in a first step. Registration officially started on January 22, 2013 and the first deadline to be granted the lowest fee was set on March 02, 2013. The participation fee rose thereafter approximately every 1.5 months (see chapter 5.2.1).

Reminder emails were sent to all delegations that had not yet registered about 10 days before each deadline.

With this system, 87.3% of all persons and 90.3% of all delegations were registered before the first deadline, as shown below.

Deadline	Nr. of delegations registered	Nr. of persons registered
March 2, 2013	56	400
April 13, 2013	60	427
June 1, 2013	62	453
July 14, 2013	62	459

**TABLE 5.10** Numbers of delegations and persons registered online before the deadline on which the participation fees rose to the next higher level.



**CHART 5.3** Online registrations of delegations per day and the total number of persons registered; the red lines correspond with the deadlines on which the participation fees rose to the next higher level. Data is shown for the period between the opening of the registration on January 22 and the beginning of the IBO 2013, July 14, 2013.

Organizers must be aware that the two future IBO hosts are allowed to bring 2 additional jury members as part of the standard delegation, hence without extra fee. Additionally, a representative of the Coordinating Center is freed of any participation fee and finally the delegation delivering the IBO Chairperson is allowed to bring a free additional jury member to the IBO (see IBO Rules).

## Last Minute / Not-Communicated Changes of Participations

In July and hence within 2 weeks of the official start of the IBO, 5 jury members and 1 student were changed or added by their delegations, generating extra work for the organizers (informing hotels, updating data bases, reprinting badges...).

Moreover, one delegation brought only 3 instead of the 4 registered students without informing the organizers, leading to confusion for the team guides and the organizers as one participant was officially “missing”. As a result, the number of participating students at the IBO 2013 was 240.

Two jury members were further accompanied privately by their partners with whom they wished to share a hotel room, unfortunately without informing the organizers in advance. This also led to confusion and additional work for both hotels and organizers, as the guests tried to change the reservation on site without concern for the arrangements made by the organizers.

## Providing Names and Personal Details

For many steps in the organization, the names and other personal details of all guests are needed early enough (hotel booking, printing of badges, certificates, yearbook...). The deadline for providing names, gender, and email addresses was set quite late to May 25 (according to IBO Guide it would be May 1), the deadline for all other information to June 19.

As opposed to the registration of the participation, the deadline for providing names and personal details was not linked to the fees; hence delegations missing the date did not have to pay an extra fee. This took into account that in some countries the national selections (NBO) take place at a later point in time.

Time point	Names, gender and email address provided
28.02.2013	17
31.03.2013	42
30.04.2013	97
31.05.2013	374
30.06.2013	454
14.07.2013	459

**TABLE 5.11** Number of persons of whom names, gender and email addresses were completely provided through the online registration system at the given time points.

About 5% of all names and 10 gender information items were entered incorrectly. Once this information was submitted online, changes could only be made through the organizers directly within the data base, as each change had to be noted and forwarded to other involved partners (hotels, documents, etc...). Nevertheless, 8 names were still incorrect upon arrival of the guests and new badges had to be printed.

Once the email addresses were submitted, each participant received an individual login, allowing all to provide their own personal details (incl. pictures, food preferences, T-shirt size, etc...). In some cases, problems were caused by the following situations:

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- Some delegations' team leaders did not provide individual addresses of each participant, but repeatedly entered their own email address. As a result, none of their participants received their personal login (a total of 50 participants never logged in personally).
  - Unfortunately, with no individual email address, information sent by email may have never reached the participants directly if it was not forwarded by a jury member.
  - Whilst all jury members were able to login and enter also personal details for all other delegation members, in some cases, and despite several reminders, no personal details at all were entered.
  - Relatively often (about 5%), email addresses contained errors, as they were not entered correctly. This cannot be controlled by the organizers and the participants consequently didn't receive their emails.
  - Some email providers are more likely to classify mass emails as spam. For all mass mailings sent out for the IBO 2013, Gmail was very prone to move all emails to the recipient's junk folder; hence the email went potentially unnoticed.

### **Providing Travel Details**

All delegations had to fill in a form about their arrivals and departures in the login section of the IBO website by June 19, 2013. This information was needed to calculate the need of shuttle busses (offered to and from Zurich and Bern Airport) as well as to plan the need of volunteers at all pick-up and drop-off locations.

Despite all reminders, getting accurate information proved to be a challenge. Many delegations submitted their information after the deadline and in case of the departures, after the IBO had already started or not at all (5 for arrival and 6 for departure). Moreover, quite some information turned out to be wrong, making the coordination even more complicated and requesting a high level of improvisation.

### **Declaration Forms**

The IBO guide states all rules that have to be fulfilled in order to be allowed to participate in the competition. Each student must hand in the so called declaration form that has to be signed by the student and its school, confirming that the competitor is a student at a secondary school. Each student must bring the original declaration form signed and stamped to the IBO registration and hand it over to the organizers. Otherwise, the student may be excluded from the competition. As a security measure, each delegation had to upload in advance a scanned version of the completed form in the login section of the IBO website.

- For 15 students of 6 delegations, no electronic version of the declaration form was uploaded but the originals were handed in during registration in Bern.
- One delegation did not bring the original forms of any of its students to the IBO. Fortunately, they had uploaded electronic versions in advance. These served as a substitute and, in accordance with the Chairman of the IBO, were exceptionally accepted.

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## Pictures

Two new features were introduced this year to the IBO (see chapter 4.1.3): the IBO Yearbook as well as an up-to-date delegations' website, listing all registered guests (and on a separate page all volunteers) and showing a picture of the person concerned. For both yearbook and website, each individual was free to upload a picture and to indicate whether the picture should be shown in the public section of the website and whether it should be printed in the yearbook.

- 26 persons uploaded their pictures too late to be included in the yearbook (deadline was extended and reminders were sent out several times).
- 44 persons did not upload any pictures at all. These included:
  - 16 students (out of 240)
  - 16 jury members (out of 207)
  - 2 observers (out of 3)
  - 10 volunteers (out of 70)
- 8 persons wished that their picture was not shown online in the public section but wanted it to be included in the yearbook.

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### 5.7.3 Observer Invitations

Invitations to potential observer countries have been sent out in November and December 2012. Besides the contacts listed at the end of the list of country coordinators provided on the website of the Coordinating Center in Prague, the following country groups have been invited:

- Contacts received from the organizers of IBO 2012.
- All members of the OIAB (Olimpiadas Iberoamericanas de Biología), a number of Spanish and Portuguese-speaking countries. They were contacted via IBO and OIAB member Spain.
- All European countries not yet members of the IBO. The invitation letter was either sent to existing contacts (in the case of Southeastern European countries via IBO member Montenegro) or directly to the Ministry of Education. Even though we received a number of replies no actual participation resulted in these contacts.

After a description of their National Biology Olympiad and a written agreement to accept the IBO Rules was received, the Steering Committee accepted Malaysia and Portugal as observers in the IBO 2013.

Besides, several additional country representatives, teachers or other individuals have contacted us directly, showing their interest in participating as observers. None of these contacts has led to any serious attempt to participate.

All additional contacts established in this process have been forwarded to the Coordinating Center.





Registration on arrival day.

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## 5.7.4 Visa

The Swiss authorities were asked for assistance to facilitate the visa applications for our guests. However, no help could be offered as each application was treated individually and each embassy had different procedures to follow.

Additional letters for visa applications were produced upon request only. A total of 22 delegations needed an additional letter. The following partially unexpected situations arose:

- As not all Swiss embassies followed the same procedures, most letters needed to be adjusted to the specific requirements of the embassy in charge, leading to an unpredicted extra load of work, often during the busiest weeks just before the IBO. Additional documents had to be delivered, often as paper copies.
- On most letters, all delegation members needed to be listed personally. As in quite some cases the selection of the students (and sometimes even of the jury members) is carried out quite late, the visa letters could be produced often only shortly before the IBO, leading to uncertainties about the participation of some delegations to both the organizers and the teams.
- Also, all changes of a person registered shortly before the IBO and after the visa letters had already been sent resulted in additional letters that needed to be produced immediately to ensure the person's participation.

As Switzerland is a member of the European Schengen Visa Area this had further consequences for some delegations:

- Whilst the Swiss embassies usually handle a visa application within 3 days, the Schengen authorities needed up to 15 days for each application.
- As for the Schengen Visa all persons applying for a visa need to visit an embassy personally, many delegations had to travel long distances for their visa. This was especially burdensome for delegations in whose country Switzerland has no embassy. In those cases, the delegations had to travel to another country to get their visa.

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## 5.7.5 Emails Sent

According to former hosts, organizing an IBO also means writing a lot of emails. To quantify this statement the number of emails written to all persons participating in the IBO 2013 (excluding any mass mailings) was monitored. A total of almost 1000 personal mails were written from September 2012 to August 2013.

Before November 2012, only a few emails were sent. Thereafter, from December 2012 to April 2013 a steady flow of about 60 emails per month was noted (with a temporary drop during January). The mail traffic increased in May with a jump up to around 150 personal contacts.

The monitoring revealed that the main peak of email sent concentrated on June with a total of around 300 mails. It was the month with the highest number of emails sent especially for visa applications. Further, on June 19 most deadlines of the online registration system ended, causing quite some additional email traffic after reminders were sent out to all those not matching the deadline.

July surprisingly dropped back to about 125, and once the IBO 2013 was over, August only accounted for less than 50 mails.

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Not all delegations needed the same attention, while 19 delegations received less than 5 personal emails, 18 caused more than 50% of all messages sent.

Further, 66 emails were sent to potential observer countries that did not participate in the end (excluding Malaysia and Portugal). See chapter 5.7.3 for more information on observer invitations. Additionally, 30 persons (mainly students or teachers) not directly linked to the IBO requested information from the organizers on how to participate in the IBO or concerning National Olympiads in their home countries. They have been given the contact details of the particular country coordinator as provided on the website of the IBO Coordinating Center. These numbers are not included in the statistics.

### **5.7.6 Registration at IBO in Bern**

Upon arrival in Bern, all guests underwent a registration process. The registration was split in several sub-entities to accelerate the procedure. It took place in the same facilities where the common room of the students was located and hence just opposite the street of the student hotel. The jury hotels were located downtown and could be reached directly with a tramway line.

As the official welcome dinner would only take place quite late in the evening, a small lunch buffet with sandwiches, snacks and beverages was offered to all guests. They were free to serve themselves before or after the registration or to pack some lunch bags for take away.

#### **Arrival at Registration Site**

All guests could store their luggage in a special room while going through registration. They were welcomed at the information desk and informed about the further steps. They were reminded to have the original declaration forms at hand money (if any fees needed to be paid), communication devices and other objects that needed to be handed in during the further process. Also, all persons were registered and ticked off a list to help keeping an overview of who arrived and who was still missing.

#### **Names, Badges, Medical Issues**

On the first desk of the registration, all guests were given their badges and would check whether their names were correctly spelled, their gender and T-shirt sizes were submitted correctly during online registration (which was unfortunately every once in a while not the case) and to inform the organizers about any medical issue that was of importance in case of emergencies. All guests then received a coupon with their T-shirt size to receive it later on together with the other presents.

#### **Declaration Forms**

All delegations had to hand in the originals of their students' declaration forms during registration. Delegations not having any originals were listed and informed that they would be contacted by the organizers later on after consulting the Steering Committee regarding further steps (see also chapter 5.7.2).

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## **Fees**

Students were separated from jury members at this point and sent to the next step (communication devices, books and objects). The team leader of each delegation was asked to check the current status of the delegations invoice and pay any missing fees in a separate room (other delegation members were invited to move on to collect their presents). Both participation fee and IBO membership fees not paid upon the delegations' arrival (see also chapter 5.7.7) were collected. An ATM with both Swiss Francs and Euros was located next to the building (a map was given to anyone in need) for those not carrying any money or not the right currency. Paper copy payment receipts were handed to each delegation, once the total amount due was fully paid. Many delegations requested the receipts to be signed and stamped, as otherwise the receipts would not have been recognized as valid by their local authorities. Also, about 10 delegations needed additional receipts on which posts were separately listed (say, the standard delegation fee on one receipt, the fee for additional jury members on another) which was not possible on the spot, as the receipts were generated automatically via data base.

## **Communication Devices**

All students had to hand in their communication devices during registration. They had to sign a form, listing all the items handed in (or ticking the box stating that they had no device to hand in) as well as stating the rules and consequences that would apply if the student was caught cheating (see appendix 8.3.5) The devices were stored in zip lock plastic bags labeled with the student code and stored in a safe in the volunteers' office next to the common room of the students. The devices stayed there until Thursday night, after the Swiss Night and hence the end of all exams, and were given back thereafter.

Unfortunately, and although all students were well aware that breaking the rule would mean disqualification from the IBO, one student did not give in all the devices and was caught by the end of the week. The student was hence excluded from the competition with retrospective effect.

## **Objects and Books**

For the public event "Biology around the World: Meet our Guests" on the Bundesplatz (see chapter 5.6.6) a biology book and an object related to biology was requested from all delegations. All books or objects handed in were listed, and labeled. They were returned after the event on Friday through the volunteers. Three books were not picked up (these were sent to the coordinators in charge after the IBO).

## **Gifts, T-Shirts and Lab Coats**

Once each individual had fulfilled all duties it was time to receive the gifts (see 5.8.2). T-shirts and lab coats were given in exchange to the coupon received on the first desk.

## **Program**

After the entire registration was completed, guests received information about the rest of the days' program. The delegations were either free to go to the lunch buffet or to proceed to their hotels. As soon as the latter option was chosen, it was time to separate students from jury as they stayed in different hotels. All guests were accompanied to their hotels by volunteers.

For those students arriving early during the day, an excursion to the Alpine Museum Bern was arranged. One volunteer did not understand that this option was exclusively available for students and spontaneously offered it also to all jury members, as it turned out with a lot of success!

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Unfortunately, as this was not planned, this initiative led to some disorder, as jury members waited thereafter for non-existent guides at their hotel lobby. As soon as this mistake was known, the organizers dispatched more volunteers to help out. It seems that in the end, all enjoyed this unexpected supplementary excursion!

### **Comment**

All delegations or rather jury members who were picked up at the train station or came to the registration site on their own ended up carrying their luggage unnecessarily to and from the registration site twice through the city. This was unfortunate and should/could have been avoided by informing them about their whereabouts in advance so that they could have checked-in or at least gotten rid of their baggage before proceeding to the registration. However, in this case, many more volunteers would have been needed to pick up these jury members.

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## **5.7.7 Payments of Participation and CC Fees**

### **IBO 2013 Participation Fees**

In order to participate in the IBO, all participation fees have to be paid either before the IBO via bank transfer or during the IBO in cash. Non-payment of the participation fee leads to an exclusion of the event (see IBO Rules).

The current amount due was constantly available in form of a proforma invoice (available also as PDF) online in the login section of each delegation. All payments received were constantly updated.

### **Bank Transfer**

Of the 64 participating delegations (62 IBO members and 2 observers) a total of 50 have paid their fees in advance by bank transfer (covering 88% of the total amount due).

Of these 50 countries, 29 transferred the correct amount of money. In all other cases, bank charges (mainly caused by intermediary/correspondent banks) of about CHF 12–14 were missing. They were paid cash during the registration in Bern. In order to prevent the loss of these fees during the bank transfer, the paying party has to instruct their bank clearly that they will pay for these specific charges as well in addition to all other bank charges.

The deadline for the receipt of all bank transfers was set to June 19. Of all payments made, 84.4% were paid punctually.

As international bank transfers can be delayed up to 14 days, a payment receipt of each bank transfer was requested. 31 of the 50 delegations have sent such a receipt to the organizers.

### **Cash Payments**

Besides the remaining 14 delegations that had not paid their fee via bank transfer and the 21 delegations that had to pay for missing amounts caused by bank charges during bank transfer, 4 delegations received cash payments back for overpaid fees.

### **IBO CC Fees**

The annual IBO membership fee has to be paid to the Coordinating Center (CC) in Prague in order to financially support the center to fulfill its functions. This can be made by bank transfer or by paying the amount due during the registration of each IBO. The organizers receive a list from the CC with all delegations that have not paid their fees until the beginning of the current

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IBO and have to collect these fees in the name of the CC in USD, EUR or CZK.

During the IBO 2013, 20 delegations paid their membership fee in cash (15 in USD, 5 in EUR). All cash was handed to the representative of the CC during the IBO in exchange of a signed receipt.

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## 5.8 Miscellaneous

### 5.8.1 Medical Issues

#### Preparations

In case of medical issues, all volunteers received first aid training before the IBO. Besides, many volunteers had medical backgrounds (doctor, nurse, several students of medicine) or were specially trained (such as scouts, sports instructors and teachers).

Each volunteer also received a first aid kit with band aids, bandages, disinfectants and sun cream lotion. Each senior and chief guide as well as the IBO head office in the Kursaal was additionally equipped with a larger first aid kit, including a wide range of medicines and a broader set of medical supplies.

Besides all food related allergies and special diets that were indicated by all guests during the online registration, everyone was asked upon arrival about further medical issues the organizers should know about in case of an emergency.

Two special medical cases were reported to the organizers ahead of the IBO. One guest had just broken their leg, whilst another suffered from a disease that did not allow to stand or walk for long periods. For both guests, a wheel chair and/or transfers by car were organized.

#### Cases Encountered

Fortunately, no major medical incidents occurred. Nevertheless, preparations proved to be valuable for several minor cases. One jury member regrettably deeply cut their hand and had to visit an emergency medical facility for stitches. Further, a student cut their hand during the Swiss Night while carving a wooden cow and was taken care of by a senior guide.

Besides several cases of minor cuts, sun burns, insect bites and various aches, two students felt too unwell to join their fellow participants on one of the excursion days and stayed in the hotel rooms. They did not wish to see a doctor. A volunteer was dispatched to be at the hotel and to take care of any needs of the ill students. Both students were recovered by the next day.

Additionally, at the end of the closing ceremony, two persons suffered a collapse and were taken care of by our volunteers.

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### 5.8.2 Gifts

Traditionally, all guests of the IBO also receive a number of welcome presents from the organizers. During the IBO 2013, all guests received the following items upon arrival:

- IBO 2013 T-shirt
- Reusable water bottle (Sigg bottle)
- Chocolate bar

- Victorinox Swiss army knife
- Swiss style cotton scarf (“Glarnertuch”)
- Swiss pin
- Baseball cap

Additionally, all students received a lab coat as well as a set of writing utensils with the IBO logo printed on and a calculator for the exams.

Many presents were offered to the IBO participants by courtesy as a supporting act, among others the Swiss army knife by Victorinox.

### T-shirts

The T-shirts were designed by a young Swiss artist who won a small design competition initiated by the IBO organizers. They were printed in four colors (red, blue, yellow and violet) depending on the status of the wearer (students, jury, volunteers, and management).

Whilst organizers and jury were free to wear their shirts at their own convenience, students were asked to wear their red shirts during the two main excursions in order to help the volunteers to keep an overview of all their guests. All volunteers (except scientific assistants) had to wear their yellow T-shirts during the entire period in order to be easily spotted by our guests. They received three T-shirts each and a laundry service was implemented to provide them with freshly washed T-shirts upon request.

The T-shirts were produced in both female and male cuts in the sizes XS to XXL. All participants were asked during online registration to indicate their desired size (providing a size table to help choose the right size). As the production of the T-shirts had to be started at the beginning of June to guarantee a punctual delivery, only the sizes provided by May 30 could be used to extrapolate the number of shirts per sex, size and color. By then, only about 60% of all guests had filled in the relevant form online.

	XS	S	M	L	XL	XXL	Total
Jury (M/F)	2/6	8/10	19/32	44/21	34/17	17/9	124/95
Students (M/F)	1/5	21/29	59/38	47/12	14/4	4/1	146/89

**TABLE 5.12** T-shirt sizes per category based on all numbers submitted during online registration. Given are the number for male (M) and female (F) cuts.

About 30 T-shirts for both students and jury were added to the extrapolated numbers for the final order. After the T-shirts were given to all guests, quite a few had to be exchanged, as either the shirts were too wide or tight or because the initially submitted sizes were not correct at all.

### Lab Coats

Students received a lab coat for their practical exams. All coats were standard white, to increase the degree of their reuse. In order to facilitate the optical recognition of the four practical exam groups, different colored armlets were used.

Lab coat sizes (equally available in female and male cut versions) were also calculated based on the T-shirt size numbers shown in TABLE 5.12.



Solemn moment: students' oath at the opening ceremony.





Practical exams needed the full concentration of all participants.

# 6. Exams

The exams are the central piece of an IBO and we, as organizers, were committed to deliver sound and interesting exams of high quality. As specified in the rules of the IBO, the exams consisted of a practical and a theoretical part, of which the practical part was further divided into four independent exams. Both parts counted equally towards the final score.

## 6.1 Practical Exams

### 6.1.1 Practicals Design

All four practical exams were designed to challenge the students with novel ideas and protocols. At the same time, they were laid out to test important practical skills such as the ability to read, understand and follow protocols, organize equipment at the work place, handle equipment, specimen and solutions carefully, further to measure and observe accurately and attentively. Finally, all practical exams were inspired by research conducted at the University of Bern and the Natural History Museum of the Burgergemeinde Bern, as well as by equipment and tools available.

The following four practical exams were prepared (actual protocols are found in 8.2.2):

#### **Practical 1 – Molecular Cell Biology (Cell):**

In this practical exam, the students were testing for the expression of surface and excreted proteins using different assays in strains of *Trypanosoma brucei*, the parasite causing sleeping sickness in humans and animals. Specifically, the students incubated a non-virulent strain of *T. brucei* cells in the presence of a substance that is cleaved into a blue product when the protein  $\beta$ -glucuronidase is expressed by the cells. In addition, the students used magnetic beads attached to antibodies specific against the surface protein procyclin to separate individuals expressing procyclin from those that don't. Finally, students were asked to estimate the concentration of cells expressing procyclin by means of cell counting chambers under a microscope. The protocol required particularly careful handling of the living cells in order not to inhibit the binding of magnetic beads to cells, as well as high concentration when observing cells under the microscope.

#### **Practical 2 – Plant Physiology, Morphology and Ecology (Plant):**

Here, students identified different *Arabidopsis thaliana* mutants that were unable to either synthesize or degrade starch. This was achieved by measuring glucose concentration in plant extracts by spectrophotometry, as well as using a classic staining assay. In an additional section of the exam, the students were asked to carefully examine the morphology of various flowers and to link that information to potential pollinators of these flowers.

#### **Practical 3 – Evolutionary Ethology (Etho):**

Students were asked to quantify various behaviors of the African cichlid *Neolamprologus pulcher* from a series of video sequences showing experiments conducted at the University of Bern. The first series of videos showed male individuals defining their territory against conspecifics in two experimental set-ups: one in which the males could only see each other through glass, and a second in which they could also smell each other in addition. Using advanced statistical techniques (analysis of variance), the students demonstrated that *N. pulcher* males use non-visual clues when assessing the strength of the opponent and are adjusting their

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level of aggressiveness accordingly. Using additional video sequences, the students further quantified brood care behavior of *N. pulcher* social groups to understand why the dominant male tolerates male helper individuals in the group. This practical exam required a high degree of concentration when observing behaviors, as well as developed analytical skills when manually calculating the statistical tests.

#### **Practical 4 – Comparative and Functional Biosystematics (Syst):**

The goal of this exam was to reconstruct the phylogeny of mammals based on synapomorphic characters observed on skulls, as well as to study the rate of evolution of several skull shape measurements. Thanks to the incredible support of the Natural History Museum of the Burgergemeinde Bern, we were able to expose the students to original skulls from 8 mammals, which they had to observe and measure carefully. The students then analyzed their data, complemented with data provided for an additional 16 species, using various phylogenetic methods such as the identification of synapomorphic characters, maximum parsimony or UPGMA (Unweighted Pair Group Method with Arithmetic Mean). Finally, the students used advanced statistical techniques to compare skull shape across species while taking skull size into account. A major hurdle in preparing this practical was that each of the 65 sets of skulls had to be measured multiple times individually before the IBO to ensure a fair marking scheme.

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### **6.1.2 Preparing the Practical Exams**

In order to prepare diverse tasks and to share the workload broadly, each practical exam was organized in collaboration with a different institute of the University of Bern and one with the Natural History Museum of the Burgergemeinde Bern, an independent institution and long-term collaborator of the university. For each practical, the institute in charge named one or two main responsible persons that teamed up with a senior person from the Swiss Biology Olympiad and functioned as the organization team for this practical (see TABLE 3.1). This model allowed to pair the detailed knowledge in every subject with the experience in IBO exams the Swiss Biology Olympiad acquired over the years, while ensuring that the planned experiments could be organized with the available equipment and within the budget.

A major challenge when organizing practical exams for an IBO is that most protocols established for teaching purposes at universities are designed to demonstrate a particular biological effect, rather than to require the students to make their own interpretation. In order to assist the organization teams in developing high quality exams, each exam thus passed through several rounds of internal review with the goal to give vital feedback during the development, to help turning functioning protocols into practical exams in line with IBO rules and traditions, and to harmonize structure, organization and layout of the four exams. The review committee of the IBO 2013 consisted of the scientific project manager of the IBO 2013 (Prof. Daniel Wegmann) and the representatives of the Swiss Biology Olympiad implicated in the four exams (Thierry Aebischer, Adeline Colussi, Michael Jutzi), which brought together extensive experience regarding IBO exams both on national as well as international level.

In a first step, each organization team developed feasible protocols in their subject and assembled a list of necessary equipment. These proposals were then discussed in the review committee regarding their ability to function as an exam. Each team then developed a fully functioning protocol on their own. In a second round of review, the protocols were discussed regarding their difficulty and time requirements and several extensions or simplifications were worked out to match the demands of the IBO. Then, organization teams went ahead to write

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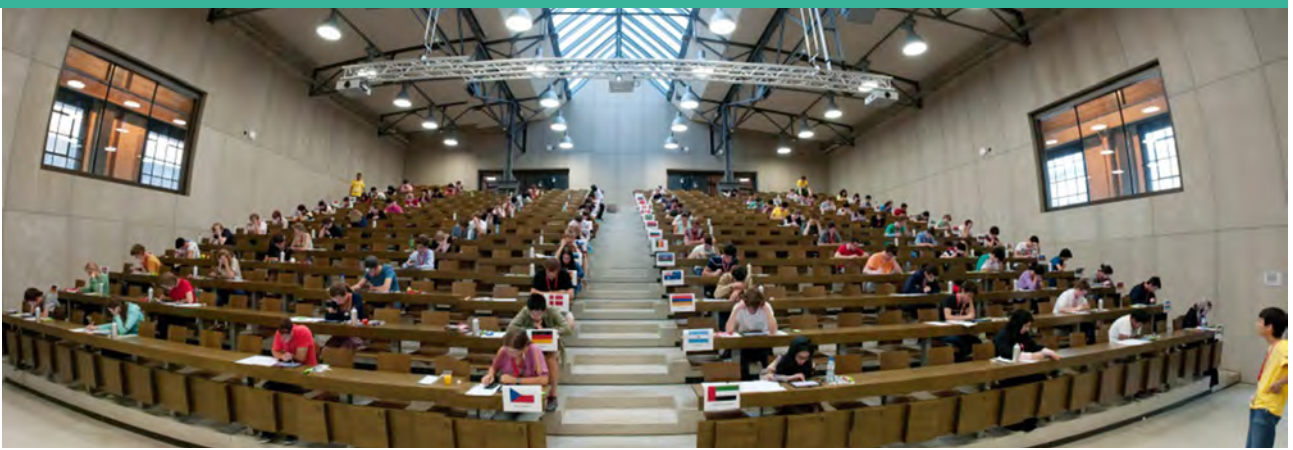
up a first draft of their exam, which was then improved over many rounds of review, with a particular focus on an easy flow and logical structure, as well as clear and concise language. Special attention was also given to a consistent presentation of concepts and tasks across all four exams, as well as to ensure the students had to report enough intermediate steps to guarantee fair marking.

Each exam was then tested on a small number of students to further assess difficulty and the time required to finish each practical. We opted for a small group of former participants of either an international or the last round of a national Olympiad instead of a larger number of university students for several reasons:

- IBO participants are known for their stunning intellectual flexibility and ability only matched by exceptional students at any university.
- First year university students are expected to be intellectually less mature than IBO participants, but second and third year students have acquired a deeper knowledge than IBO participants.
- In contrast, former IBO or NBO participants in their first or second year of study match the top IBO participants in many key characteristics.
- Finally, we felt it was harder to meet the confidentiality requirements with a large group of students.

We thus organized test sessions for each practical exam for 6-8 former participants, complemented with members of the review committee. While these sessions reassured us regarding the overall difficulty, they helped us identify unclear or imprecise formulations and, more importantly, highlighted the need to shorten three of the four exams. How to do this became in all cases easily apparent when discussing with the people that just worked themselves through the exams, as it allowed us to quickly estimate the time gains of several proposed reductions. To include the review committee in the test sessions proved to be extremely helpful for further clarifying the writing and extending the harmonization to how work places were arranged and equipment was presented and labeled.

Finally, each practical exam was discussed meticulously in the international subgroup during one half day. This allowed us to get external feedback from another group of people having substantial experience with IBO exams. To guarantee a careful review, the international subgroup was presented a sample workplace for each practical exam, matching the workplaces used for the participants both in content and in space. While the subgroup was generally extremely happy with the exams, this extra time allowed us to improve structure, presentation and wording of the exams with an attention to detail that would be impossible in the jury sessions during the IBO itself. A good example were discussions around the structure of answer tables that lead to a clearer and more consistent layout for the students in several cases – a change that would have been much more difficult during jury sessions since translations are usually already under way when discussing the exams. The same is true for images, several of which could be improved during the subgroup meeting.

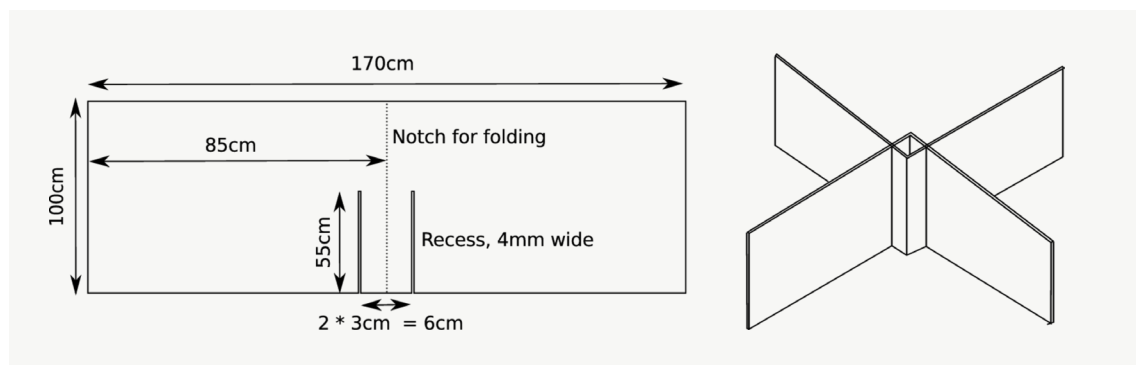


Students at work: taking the theoretical exams digitally on tablets - an innovation of IBO 2013.

### 6.1.3 Setting up and Running the Practical Exams

In order to reduce the necessary equipment and as usual for an IBO, each practical was organized in four sessions with the students rotating through each exam. To avoid communication between students from different groups, the exams were organized in geographically different locations, which included different rooms for the students to relax between exams and also two different locations to have lunch. Meeting all these requirements was only possible by organizing two practical exams that did not require wet lab equipment, but could be held in ordinary lecture rooms close to a second cafeteria.

Since practical 3 (Etho) only required minimal equipment (computer tablet with videos only), we were able to organize this exam in a large lecture room. This was, however, not possible for the other three practicals. These required the handling of material, which would allow students to copy experimental procedure from others by observing them. Following the tradition of previous IBOs, we thus organized the work places of these three practicals in cubicles that were walled on three sides to shield the competitors off from each other. While previous IBOs often built up impressive cubicles using wooden structures, we opted for a cheaper, recyclable and less labor intensive solution based on cardboard (see FIGURE 6.1), which was feasible despite the elevated risk of fire because Bunsen burners or similar equipment were not required in any of the practicals.



**FIGURE 6.1** Cardboard cubicles for practical exams:

*To save money, material and the time required to set up the practical examination rooms, we decided to construct cubicles from identical cardboard pieces (left). Two such pieces were then put together to a cross-like structure by matching the recesses (right). Putting multiple such crosses together resulted in always two cubicles facing each other. Since the crosses were able to stand on their own, they were tacked together and taped to the tables / benches where necessary.*

Preparation of the exam rooms could not start before Saturday July 13, just before the IBO, due to constraints on most rooms (some could only be used as of Monday) and because our volunteers were not available earlier. An additional challenge was that the people in charge of the practical exams were also required in the jury session during the discussion of their exams on Monday while at the same time the equipment was installed. It was thus important to organize all necessary equipment such that individual work places could be installed easily and quickly.

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Since the time between exam sessions was limited to only little more than one hour, there was the additional need to rearrange used workplaces in a few minutes only. We thus prepared sufficient aliquots of all solutions and samples before the exam sessions, but given that we worked with living cultures in practical 1 (Cell), these aliquots had to be prepared overnight just before the exams.

In order to reduce costs and to ease communication, we attempted to keep the number of volunteers minimal. Therefore, all practical exams were organized with 3-5 scientific volunteers each, complemented with 5-8 team guides on the exam day to help setup the workplaces during the sessions. This implied that a large fraction of the staff involved on the exam days (i.e. team guides) could not be trained before the exams started, requiring us to streamline and simplify the process of setting up the workplaces as much as possible and to be able to train part of the volunteers in less than 30 minutes. While challenging, this worked out well overall with the break between the first two sessions being admittedly rather hectic.

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## 6.1.4 Marking Practical Exams

### Barcoded Answer Tables

A novelty of the IBO 2013 was to abstain from using answer sheets for the practical exams. Instead, the students were asked to fill in their answers directly into tables provided in line with the protocol. This was done to reduce confusion during the exam for the students, as well as to ease translation. Since exam sheets are easily mixed up both by the students during the exam and the by marking team, we implemented an automatic answer table recognition system using barcodes. The basic idea was to tag each answer table individually with a unique barcode encoding the practical exam as well as the number of the question in the sequence.

This barcoding system also allowed us to minimize paper usage. The exam papers handed in by the students were first scanned and then put aside for future reference. An in-house computer script then processed the scanned files and extracted the answer tables in the correct sequences and pasted them into a new pdf that was then printed and used in the marking process. The marked sheets were then scanned again. Finally, the jury was given access to the scans of both the raw papers from their students, as well as the sheets used during the marking process.

While elegant in theory, we struggled with the system for two independent reasons. First, it was not communicated well to the jury to bring their IT equipment to the review session on Friday to check the marking, making it necessary to bring the paper versions to the jury later that day and requiring the jury to come to an extra session the next day.

Second, we experienced issues with our in-house script to extract answer tables when multiple scanners were used at the same time at the same computer, resulting in students having been marked on answer tables copied from other students scanned at the same time. This issue was recognized during the marking session and the answer table extraction was carefully checked by hand. Due to the immense time pressure under which marking at an IBO has to be completed (< 48 hours), such mix-ups went unnoticed in three cases. One of those was recognized by the jury members of the affected delegation and corrected before the final ranking was assembled. An additional case was detected by an affected student only one month after the IBO when the students were given access to their exam papers. As a result of that complaint, the marking team went back to manually check all marked papers. During that process, a third case was uncovered. The exams of all affected students were marked anew and their position in the ranking was updated (see chapter 6.2.4 section „Compiling the Final Ranking“).

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However, we are still convinced that the general work flow was appropriate and we recommend future hosts to consider it seriously. The decision to scan rather than copy the student exams reduces the overall paper consumption considerably and the script to extract and order answer tables can easily be extended to deal with multiple scanners properly. Alternatively, the exams could potentially also be marked directly on the original exam papers, if the originals are scanned first.

## **Error Carrying Forward**

All practical exams were designed to expose students to the whole scientific process including taking their own measurements, analyzing them using statistical methods and finally interpreting them. While we are convinced of the pedagogical value of such an approach, marking turned out to be extremely demanding since we had to grade all practical exam questions by taking each student's measurements into account and carrying all mistakes forward throughout the exam. To speed up this process, we prepared specific spread sheets for all questions and marked by copying the results of each student to those sheets. But since many students made plenty of mistakes even in simple calculations, the results of the student had to be copied to the spread sheet anew for almost every question, making the marking process extremely slow. As a result, we recommend balancing the exam with more questions that do not require error carrying forward marking, even though we recognize that this is difficult to implement, particularly when advanced statistical calculations are to be used. Alternatively, a system that would require the students to enter their results in a digital format (e.g. via computer tablet) could speed up the marking considerably as even elaborate error carrying forward schemes could be prepared as computer scripts well before the actual exam takes place.

## **Jury Session to Check our Marking**

Due to the difficulties described above, it turned out that we completely underestimated the actual time it would take us to mark all practical exams. In fact, we only finished the marking 30 minutes prior to the jury session devoted to the checking of the marking. While thus ready for that session in theory, we did not communicate well that we prepared no paper copies of our marking, but only digital scans. As a result, most of the jury members did not bring their personal computer to the session. However, for financial reasons, we only prepared a room with fewer tables and did not provide computers for this session, resulting in many delegations not having the means to actually check the marking. To add to the list of issues, we also experienced space issues on the rented server because the company misconfigured where backups would be made. We were thus not able to provide the scans through the usual interface, but had to rent additional webspace on the fly, to which all scanned files were uploaded. The files were thus presented to the jury as a long, hard to navigate file list instead of the neatly designed system we used during the jury sessions.

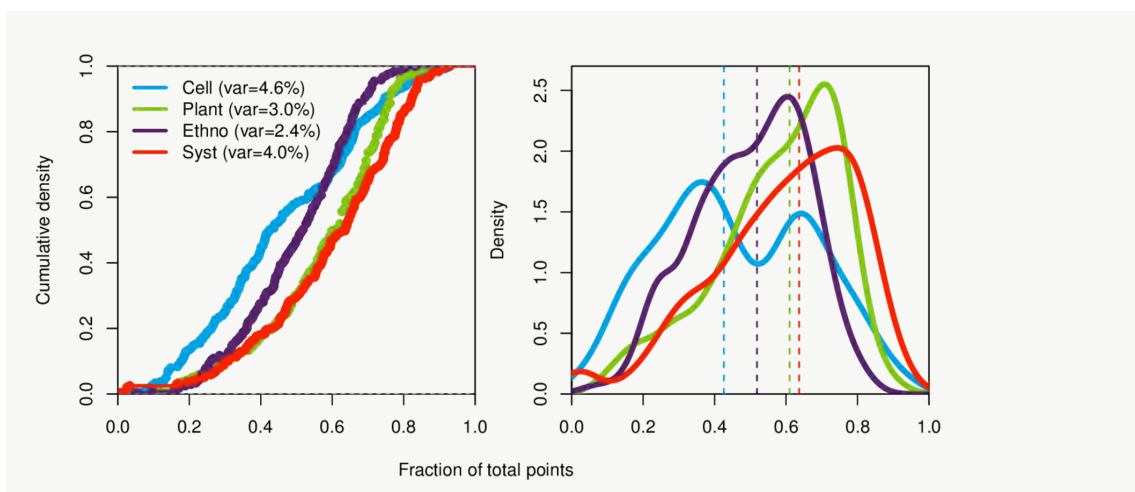
Since it was really difficult to work under these conditions for many delegations, it was decided to organize an additional session the next morning (Saturday) and to bring the paper copies used during the marking to the place at which dinner was held on Friday. While several delegations checked the marking late night at their hotel, this system worked out in the end for most delegations and the session on Saturday morning went really smooth. The most surprising experience during that session was that we received at least as many requests to reduce the number of points given, as we received requests to increase the number of points for a student. This is probably the nicest experience to highlight the extremely strong commitment of fairness within the IBO.



## 6.1.5 Statistical Analysis of the Obtained Scores

### Total Scores

Overall, practical exams 4 (Syst) and 2 (Plant) turned out to be the easiest with a median score of 64% and 61% of the maximum attainable score, respectively. In contrast, the median scores of practicals 3 (Etho) and 1 (Cell) were only 52% and 43%, respectively. In contrast to high school or university exams, the exams at an IBO are not designed to test a particular set of skills, but to get a reliable final ranking. As a result, the distribution of the obtained scores is desired to be broad and ideally uniform. As shown in FIGURE 6.2 the distributions of the scores obtained in the four practical exams of the IBO 2013 are all relatively broad, but nonetheless clearly non-uniform. This is well in line with results from previous IBOs, highlighting the difficulty to design even more discriminating exams.



**FIGURE 6.2** Distribution of scores:

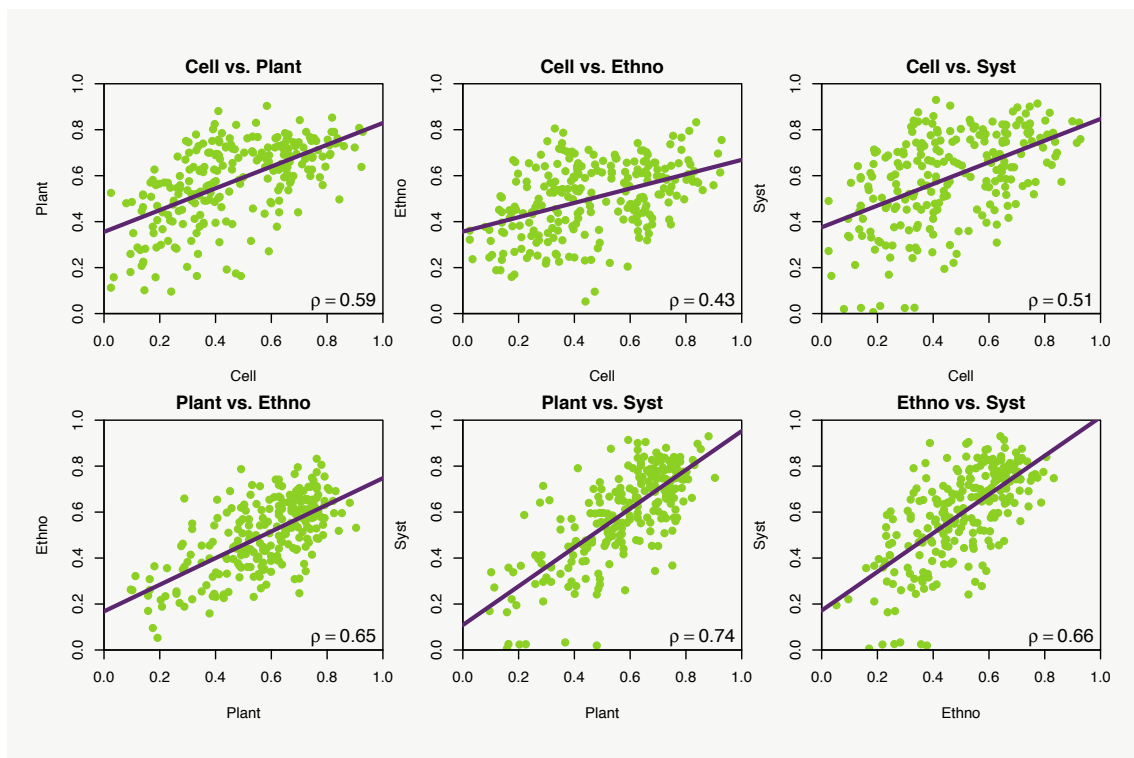
*The cumulative (left) and actual distribution of points obtained by the participants are shown for each practical exam. The points were standardized such that 1 corresponds to the maximum number of points that could be obtained in an exam. Dashed lines indicate the median scores.*

Among the exams, practical 3 (Etho) had the smallest variance (2.4% after standardizing the scores by the maximum number of attainable points), practicals 1 (Cell) and 4 (Syst) the largest (4.6% and 4.0%, respectively). The larger variance observed for practical 1 (Cell) is partly explained by the bi-modal distribution of the obtained scores, which is itself due to a large amount of points that could only be obtained when conducting a particular experiment (pull down of cells expressing procycline) very carefully. It is thus expected that this practical suffered from increased stochasticity, probably reducing its power to accurately discriminate among students. These results hence suggest that the design of this practical could have been optimized by better balancing the attribution of points such that a single step would have less impact on the total score.

### Informative Variance

Since each practical exam is an independent but noisy assessment of the skill of students, it is of interest to estimate the variance in the data that is informative about the performance of students (in contrast to being purely stochastic). A first indication can be obtained by look-

ing at the pairwise correlations between the individual exams (FIGURE 6.3), which were all highly significant ( $p < 10^{-10}$  in all cases). While we found the average pairwise correlation to be relatively strong ( $\rho = 0.60$ ), correlations involving practical 1 (Cell) were lower ( $\rho = 0.51$  on average) than other comparisons ( $\rho = 0.68$  on average), suggesting that practical 1 (Cell) is affected by more stochasticity. This is further confirmed by the correlations of the scores obtained in practical and the theoretical exam (FIGURE 6.4), which were again all highly significant ( $p < 10^{-15}$  in all cases). The average correlation was found to be very high ( $\rho = 0.68$ ) and actually higher than the average pairwise correlations among practical exams, suggesting that the scores obtained in an individual practical exam are more stochastic than those in the theoretical exam as a whole. As expected, practical 1 (Cell) showed the weakest correlation with the theoretical scores ( $\rho = 0.56$ ) and practical 4 (Syst) the strongest ( $\rho = 0.79$ ).



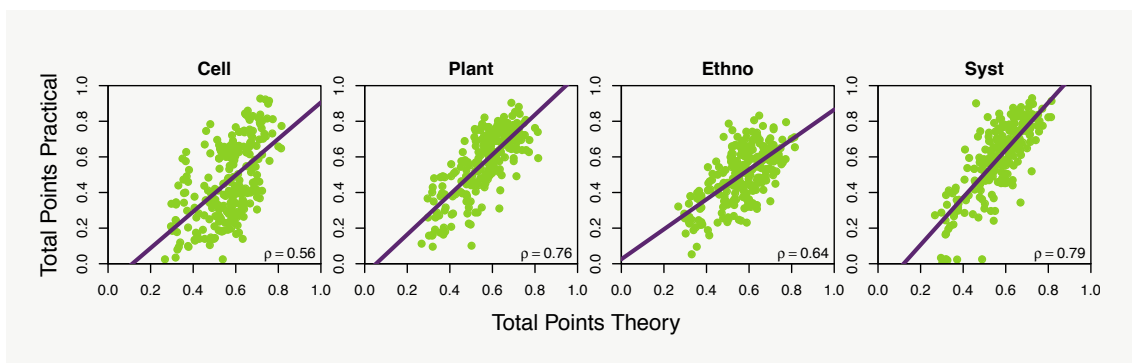
**FIGURE 6.3** Pairwise correlations of practical exam scores:

*Each dot represents the scores obtained by a participant in two different practical exams. Purple lines indicate linear regression results and Pearson correlations coefficients ( $\rho$ ) are given in the lower right corner of each panel.*



**TOP** Jury session: time to vote.

**BOTTOM** Jury at work, concentrating on the exams and their translation with the especially developed computer program.



**FIGURE 6.4** Correlations between practical and theoretical scores:

*Each dot represents the total scores obtained by a participant in the theoretical exam and in one of the practical exams. Scores were standardized such that 1.0 corresponds to the maximum number of points that could be obtained in an exam.*

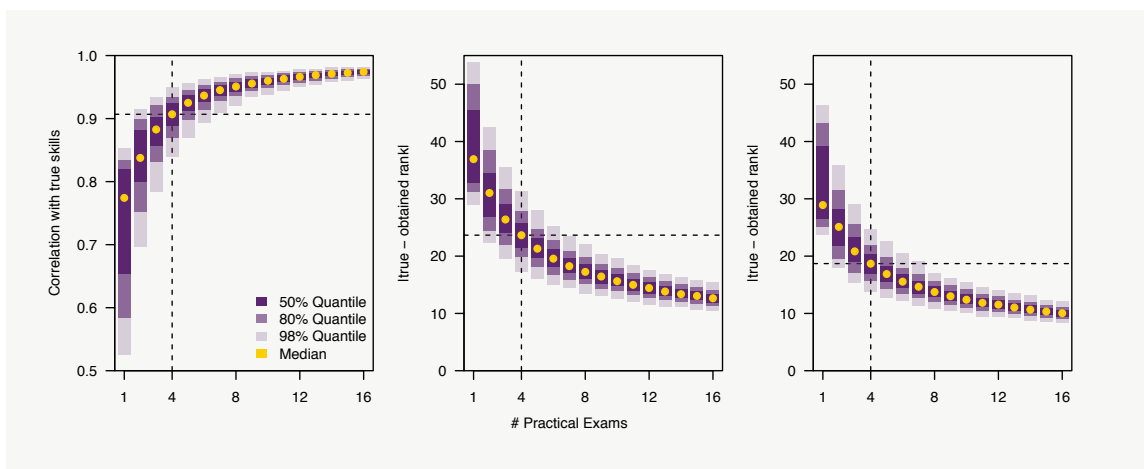
A crude estimate of the fraction of the total variance that is informative among all practical exams is obtained by assuming that the results of the theoretical exam reflect the skills of students perfectly. Under that assumption, the fraction of the total variance that is informative is given by the fraction explained by the theoretical scores in an Analysis of Variance (ANOVA) framework. This way, we estimate that 67% of the total variance is informative. Since the theory scores are themselves only a stochastic estimate and since it is likely that some students differ in their theoretical and practical abilities, this is likely an underestimate.

It is interesting to note that when conducting a principal component analysis (PCA) on the data, the first component of a PCA analysis explains 70% of the total variance and exhibits strong and highly significant correlation with the total scores of the theoretical exam ( $\rho=0.82$ ,  $p<10^{-15}$ ). In contrast, the second component explains only an additional 17% of the total variance and is only weakly correlated with the total scores of the theoretical exam ( $\rho=0.16$ ,  $p=0.01$ ), and the remaining components are not correlated at all ( $p>0.2$ ). In summary, this analysis also suggests that the majority of the variance in the practical scores is indeed informative. An approach to estimate the variance that is informative about the abilities and skills of students of a specific practical exam is to compare the results obtained in that practical with an independent estimate of the true abilities of students. Such an estimate can be obtained by combining the scores from the three other practical exams as well as the total score from the theoretical exam. To be specific, we applied the t-score method generally used in the IBO based on all practical exams except x and the theoretical scores when estimating the estimation error of practical exam x (see Chapter 6.2.4 “Statistical Analysis” for a discussion of the t-score method used in the IBO 2013). Using such an approach, we find large differences between the practical exams. As expected from the bi-model distribution of scores and weaker correlations to other practical exams, only 35% of the variance in practical 1 (Cell) is expected to be informative (as estimated via an ANOVA). In contrast, practical exams 2 (Plant) and 4 (Syst) both boost 67% of informative variance. With 47%, the fraction of informative variance was found intermediate for Practical 3 (Etho). It is to note, however, that these are likely underestimates since our estimate of the true abilities remains stochastic.

It is also straight forward to estimate the error with which the scores of individual practical exams are associated by fitting a linear model to the scores where the explanatory variable is the true ability of students estimated as above and by assuming that the errors are normally

distributed (visual inspection proved this to be a reasonable assumption). These fitted models can then be used to estimate the uncertainty in IBO rankings. To do so, we simulated practical exams by randomly picking one of the four estimated models. In addition, we assumed that the true abilities of students were distributed as estimated when combining all four practical and the theoretical exam using the t-score method. For each simulation, we used the t-score method to obtain a final score across all simulated practical exams and calculated two statistics summarizing the quality of the obtained scores: 1) the correlation between the obtained scores and the true abilities assumed in the simulation, and 2) the average difference between the rank based on the simulated scores and the true rank given by the true abilities.

The results of these simulations are shown in FIGURE 6.5 for different numbers of practical exams to be used. Based on this model, we estimate that the correlation between the true abilities of students and the final practical score to be relatively high (median  $\rho$  across 1000 simulations was 0.91) when four practical exams are used, but this still results in a ranking with a high degree of uncertainty as each student was on average 24 ranks away from where he was supposed to end up. While reducing the number of practical exams is expected to worsen the quality of the final ranking considerably, increasing the number of practicals has a more moderate effect. In contrast, a considerable improvement of the ranking could be obtained by designing the practical exams in such a way that the relative abilities of the students appear more uniformly distributed.



**FIGURE 6.5** Quality of Ranking:

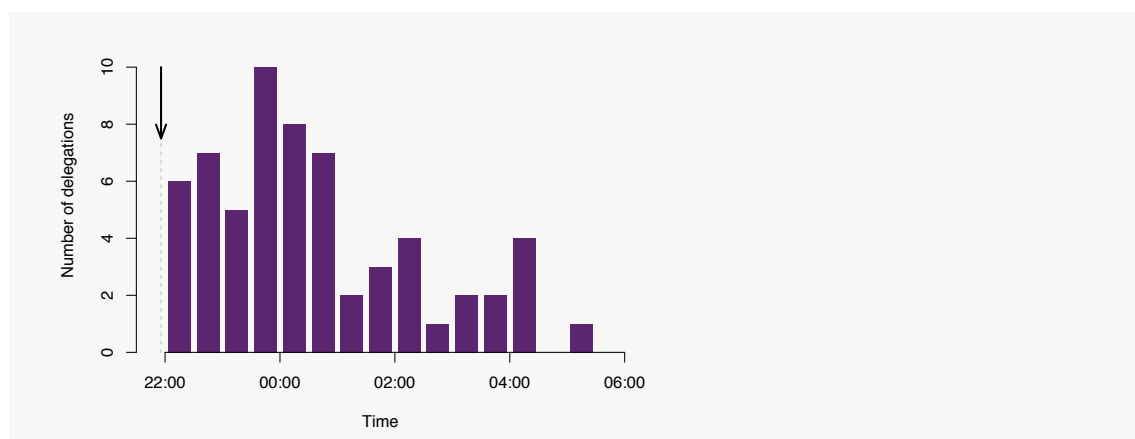
*We simulated practical tests with varying numbers of individual practical exams where the scores of each exam were generated using general linear models fitted to the practical exams of the IBO 2013. The simulations assumed the abilities of students to be distributed as identified by the total score at the IBO 2013. For each simulation, we calculated the correlation between the abilities of students and the obtained final score in the practical test (left), as well as the average difference between the rank resulting from the total score and the rank based on the ability of the students (right). Shown are the median as well as different quantiles of these metrics obtained across 1000 simulations. We then also repeated the simulations assuming that the abilities of students were distributed uniformly within the same range (right). Dashed lines highlight the use of four practical exams, as is currently done.*

## 6.1.6 Reception of the Practical Exams

### Reception by the Jury

Thanks to the meticulous reviewing process, we were able to prepare interesting and challenging exams that were extremely well received by the international jury. We have several indications for this. Firstly, only a very small number of changes (on average less than 10 per practical) were requested during the jury discussion. Among the practical exams, practical 1 (Cell) was changed the most with about 4% of all words affected by a change. In contrast, only 2.6% of all words were changed in practical 2 (Plant) and 4 (Syst). None of the changes altered the exam qualitatively. Rather, most changes requested by the jury aimed at reducing potential ambiguities by adding small clarification. As a result, the practicals were extended by 0.7%, in terms of characters. Among the practical exams, practical 4 (Syst) was extended most (1.2%) and practical 2 (Plant) was the only one that was slightly reduced in length (0.1%). Secondly, the discussion in the jury session went extremely smooth and was finished in less than one hour per practical on average, despite the fact that the jury was given a lot of time to study the exams before the discussion (all of Monday morning). Thirdly, the jury rated the quality of the exams very highly in a survey conducted after the IBO (see Chapter 7 Survey).

The high quality of the exams was achieved with the total length of the exams similar to recent IBOs. On average, the exams were 2786 words long, which corresponds to a total of 13,172 words. In comparison, the exams of 2010, 2011 and 2012 were 14,121, 11,281 and 10,356 words long. As a result and thanks to the extended time available for translations (all of Monday), most delegations finished their translations relatively quickly after the final revisions were made available (FIGURE 6.6). However, few delegations did nonetheless work until past 04:00 a.m. on their translations. Furthermore, it was a source of great satisfaction for the organizers to see that all delegations decided to translate the exams digitally – for the first time in the history of the IBO.



**FIGURE 6.6** Time at which translations were finalized:

*For each delegation we recorded the time the final version of all four practical exams was uploaded to the server. Shown is the distribution of these times as a histogram with bins of 30 minutes. The arrow and the dashed line indicate the time at which the last document with the changes made by the jury was made available by the hosts.*

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Nonetheless, waiting for the final revision was a bottleneck for many delegations. The reason for the long delay between finishing the discussion and the release of the revised version was that some of the requested changes required the clarification of some figures, which could be done easily only by the people implicated heavily in the development of the exams. However, as those same people were also involved in the discussion as well as in setting up the exam rooms, such changes took longer than planned. We thus recommend future hosts to brief an extra person on all aspects of the practical exams such that even changes of the figures can be executed during the sessions.

A well-received novelty of the IBO 2013 was that we did no longer require the jury to print the practical exams themselves. Instead, each delegation had to upload their exams as pdf files and digitally indicate the correct file to be used for each student. To accommodate the need of delegations with multiple languages, different files could be assigned to different students of a single delegation. It was then the task of volunteers to print the exams and to put them into envelopes. This not only greatly reduced the waiting time of delegations that finalized their translations, but also allowed us to verify the content of the exams carefully. This way, it was for instance noticed that one delegation uploaded the original exam file rather than their translation for one practical exam. Since the jury members were unable to be reached via phone, the printing crew used Wikipedia to search for other delegations using the same or a similar language and provided the students with such a translation instead. Just before the exam started, our volunteers were then able to reach a jury member of the affected delegation, only to receive confirmation that the translation provided to their students was actually the result of a joint translation effort between the two delegations. As a result of the careful work of the printing staff, we had no single request regarding missing pages or a mix-up of languages or exams by any of the participants during the exam.

Printing the exam papers ourselves allowed us further to add student and practical specific cover sheets with labels that identified the student, the practical and the matching exam session that were visible through a window in the envelope. These cover sheets were further printed on colored paper for easy identification of the practical they were to be used in and also contained a barcode identifying the student and the practical in machine readable format. This made the handling of the papers for the different exams and sessions easy for everybody involved and allowed us to automatically attribute exam papers to students. It facilitated also the attribution of practical exams during the marking session as the scanned pages could be grouped and ordered using computer scripts.

### **Reception by Students**

Many team guides reported that their students actually enjoyed the exams – the probably biggest compliment to get from students. While this is anecdotal evidence only, a similar impression of the exams was conveyed by the students through a representative survey conducted at the end of the IBO (see chapter 7). Well above 70% of all students were either very or extremely happy with how the exams were organized and conducted with less than 6% being unhappy about the exams. However, students rated the exams to be rather difficult (average 4.12 where 1 is too easy, 3 is appropriate and 5 is too difficult). However, since IBO exams discriminate best between students when the obtained points are broadly distributed and half of the students obtain more than half of the points, such a verdict is expected and probably speaks for an appropriate difficulty of the exams over all.

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## 6.2 Theoretical Exam

### 6.2.1 Format of the Theoretical Exam

Singapore and Switzerland, the hosts of the IBOs in 2012 and 2013, were asked at the AB meeting in November 2011 in Prague to abstain from using classic Type A multiple choice questions. This was a result of a delegations' attempt to cheat by transmitting the correct answers to their students before the exam, which was felt to be much easier when Type A questions with a single correct answer were used. In addition, there was a tendency observed at previous IBOs that the questions of Type A are often testing lower cognitive levels than other questions.

Since we decided early on to use computer tablets for the theoretical exam, we thus began searching for alternative question types that would be easy for the students to answer on a tablet. As a result, question types requiring writing letters into boxes as was used at previous IBOs were discarded. However, we identified several question types that we deemed usable: matching of items out of two lists, ordering items, simple calculations and multiple-true-false statements (MTF). After an extensive literature review and talking to local assessment experts from the Institute of Medical Education at the University of Bern, we decided to focus on MTF questions only, due to various reasons. Firstly, the literature as well as the assessment experts strongly recommended focusing on a single or very few different types only, since the exam is not about testing the students' flexibility to cope with different types of questions. In addition, we felt it would be easier to develop questions of a single type when working in a group of multiple people. Finally, mixing different types makes marking really difficult. This is particularly true for formats such as matching and ordering, as they require rather complex marking schemes when partial grading is to be used. A single mistake in an ordering question such as putting the first statement wrongly at the end of a sequence, for instance, leads to the position of all items being wrong. As a result, each question type requires a unique marking scheme, rendering the use of different types difficult.

Among the possible types, the MTF format was particularly appealing to us because it permitted an easy implementation in a digital format and the use of an easy grading system. Most importantly, however, the MTF format allowed us to diversify the topics asked by using independent statements. In discussions with the local assessment experts, we realized quickly that one of the largest contributors to stochasticity on exams was the choice of topics. The theoretical exam of a typical IBO consists of roughly 100 questions, as this was found to be the amount of question that could be discussed and translated by the jury, as well as solved by the students in the available time. When using a question format such as Type A multiple-choice questions or matching question, no more than 100 different topics can be questioned, as such types require the individual statements to be harmonized. Since the choice of tested topics is somewhat random, the ranking among the exact same students is expected to vary considerably among multiple replicates of such tests. While the number of questions can hardly be increased, the MTF format offers an easy way to diversify the topics asked, as individual statements are not requested to be as harmonized as in other formats. As a result, MTF questions were shown to be more reliable in assessing students than other types (e.g. Frisbies (1992), *Educational Measurement: Issues and Practice*).

A disadvantage of MTF questions is that they have been shown to generally test lower level cognitive abilities than MC items (e.g. Haladyna et al. (2002), *Applied Measurement in Education*). Since this is, however, not due to the format itself but to how such questions are





Jury working on the questions: intensive and valuable discussions to prepare challenging and interesting exams for the students.

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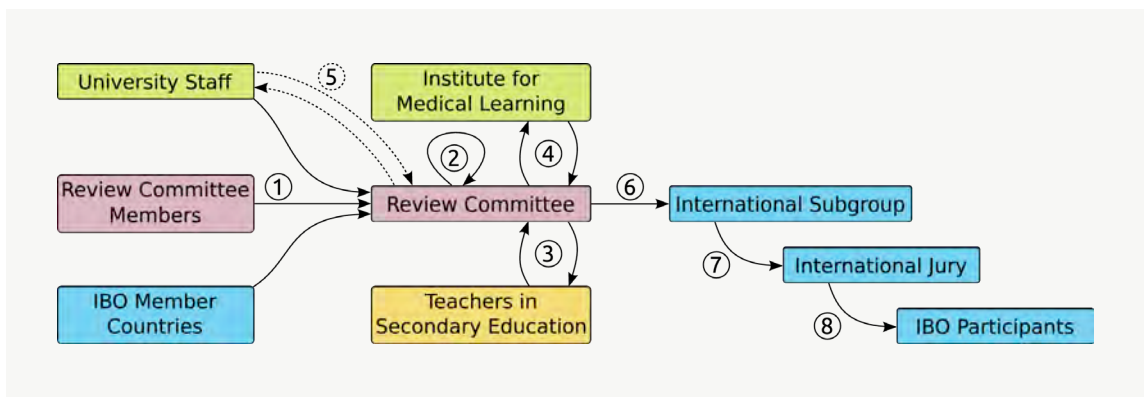
written, it implied that we would have to be extra careful when developing our questions not to simply test factual knowledge, but to find a way to force ourselves to develop questions that tested reasoning and the application of knowledge instead. Since IBO participants are to be assessed based on their scientific abilities, it was obvious to us that we should thus try to focus on MTF question that were built around the most basic of all scientific principles, namely the design and interpretation of experiments and the application of theoretical results to generate predictions. The stem of most of our questions thus described a recent experiment or theoretical result and the four individual statements tested the ability of the participants to understand experimental protocols, to detect flaws in the experimental design, to interpret the results of an experiment correctly and to use obtained results to make accurate predictions. This allowed us to combine statements testing different concepts or ideas based on a common stem, and we hoped it would also make the exam interesting for students, as they would actually learn about a lot of scientific achievements that were recently published.

## 6.2.2 Preparing the Theoretical Exam

In order to have a diverse input of question topics, each institute of the Department of Biology of the University of Bern prepared their share of initial draft questions. This also allowed us to meet the additional goal to design questions to a large extent around topics in which the university is currently actively conducting research. In each institute, one or two persons were in charge of handling the communication between the IBO 2013 organizers and the staff involved in question writing (see Chapter 3.2). These people were initially briefed on the format of the theoretical questions, as well as in specific requirements to ensure high quality questions, and later took the role to motivate other people in the institute to write questions or to coach them, to some degree, on the requirements.

The draft questions were then submitted to the review committee, which was the central committee in charge of assembling the theoretical exams (FIGURE 6.7, and Chapter 3.2.2). The review committee was composed entirely of people that were involved in both National and International Biology Olympiads and had hence a long experience in writing and discussing similar types of questions. The idea behind such a composition was to guarantee that the final questions had a high chance of passing smoothly through the international jury. In order to further strengthen the quality of the review, all committee members attended a half day course on question writing organized together with the Institute of Medical Education from the University of Bern.

In addition to those questions submitted by the university staff, the review committee also accepted questions from IBO member countries. All questions received were classified into three different categories: A) interesting question to keep for formal improvement, B) not usable in its current form but presenting an interesting topic or C) not interesting enough to keep for further discussion. While only few questions received from IBO member countries could be classified as A or B, most questions we received from the university staff were classified in category B. In other terms, most of these questions contained really interesting ideas and concepts, but suffered from formal issues. In total, about 2/3 of the final questions were based on input from the university staff, but only a handful were based on input from questions received from IBO member countries. The remaining questions were written by members of the review committee themselves to cover missing topics.



**FIGURE 6.7** How theoretical questions were prepared:

The central body in charge of assembling the theoretical exam was the review committee, which evaluated and improved questions received from both staff from the Department of Biology of the University of Bern as well as IBO member countries. The members of the review committee further developed a large number of questions themselves to cover missing topics. All questions were additionally reviewed by a board of high school teachers as well as an assessment expert from the Institute of Medical Education of the University of Bern before being presented to the international subgroup and later the international jury of the IBO. Colors represent involved bodies (green for the university, purple for the IBO organization and blue for official IBO bodies).

All questions accepted were distributed among the review committee members for further improvement based on the comments assembled during committee discussions. Aside from ensuring the scientific correctness and formal requirements regarding question design, the committee also invested considerable time to find clear and succinct formulations and worked hard on a self-explanatory and coherent graphical presentation through the exam. To achieve this, all figures were redrawn by members of the review committee according to common design principles and subjected to just as thorough a review as the question itself. Finally, the review committee also made sure that the distribution of correct statements reflected a completely random distribution (0, 1, 2, 3 or 4 correct statements with frequency 6.25%, 25%, 37.5%, 25% and 6.25%, respectively).

Once improved, the questions had to pass to a second round of internal review and subsequent round of improvement, either by the same or a different committee member. The questions were then sent to several high school teachers (FIGURE 6.7 and CHAPTER 3.2.2) to obtain feedback on overall difficulty and understandability, but also formal considerations. This additional round of external review was extremely helpful in identifying imprecise formulations and flagging complicated sentences, as the teachers involved all had a long experience in phrasing questions for students about the same age as IBO participants. The review committee then improved the questions further based on the feedback received.

All questions were then also reviewed by an assessment expert from the Institute of Medical Education from the University of Bern (FIGURE 6.7). While often unfamiliar with the scientific topic of the question, the assessment expert provided highly valuable feedback on the overall design and proposed very often embarrassingly simple solutions to improve the questions considerably. Since the questions passed through all these stages of review at different times, this formal review by the assessment expert also provided an important basis for

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improving the questions already in the review committee.

Since all questions were modified substantially since submitted to the review committee, some questions were sent back to the original developers for a final fact-checking step. While generally advisable to conduct, this last step proved difficult for various reasons and was thus conducted only for about 1/4 of the questions. A major challenge was that the review committee was lacking the time to carefully explain the reasons behind the large number of changes applied to the questions. As a result, several authors had difficulties understanding why the final questions only marginally resembled their original work and failed to see the importance of their original input. In addition, many of the final questions were composed of input from different authors because the review committee actively tried to diversify the individual statements of each question. A proper review of each statement required a large logistic effort, for which the time was lacking during the last hectic weeks before the IBO.

Finally, all questions were discussed meticulously in the international subgroup during two full days. This allowed us to get external feedback from another group of people having substantial experience with IBO exams. While the subgroup was generally extremely happy with the exams and only very few questions were changed substantially, this extra time allowed for an attention to details regarding language that would be impossible in the jury sessions during the IBO itself. As a result, the presentation of many questions could be improved considerably during that process.

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### 6.2.3 Running the Theoretical Exams on Computer Tablets

For the first time in the history of the IBO, the theoretical exams were conducted digitally on computer tablets. A major benefit of taking the exam digitally is that it allows rapid and automatic marking of the exam. It is also easier to develop software to assist the jury in translation. While also possible when paper exams are used, the large number of different languages and fonts makes it hard to define simple rules to layout an exam from translated snippets only, especially regarding page breaks and the position of images. In contrast, the use of scrollable pages without limit of length based on a web browser does allow for such rules that apply to any language or font. Finally, taking the exam digitally reduces the handling time of the exam by the staff once the translations are over (i.e. no need to print, transport or distribute the exam papers). The used system was developed primarily by five people, four of which former participants of an IBO as well as having been on the international jury at least once.

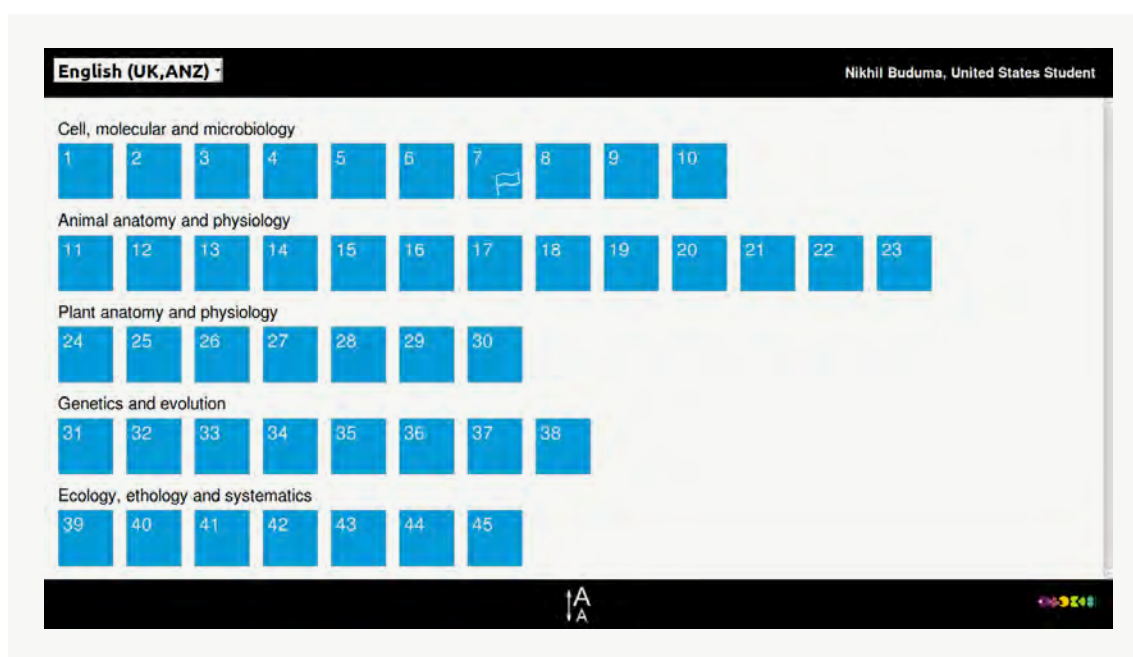
Name	Function
Daniel Wegmann	Original concept and project management
Jonas Helfer	Implementation using the Django framework
Roel Baars	Design and implementation of graphical user interface
Olivier Rion	Installation and management of servers
Fabian Egli	Development of the internal XML format and implementation of tools to print exams as pdf

**TABLE 6.1** People involved in the development of the translation and testing software.

## Student Views

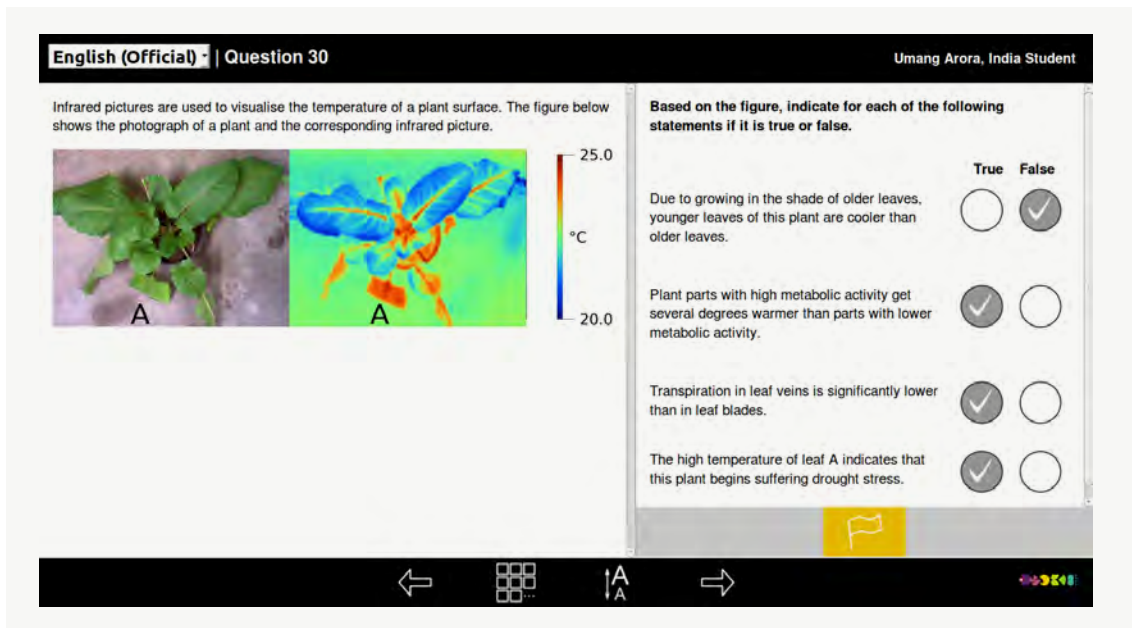
We thus decided to implement a system that would present the exam to students on computer tablets. The reasons for using computer tablets instead of actual computers were twofold. Firstly, buying computer tablets turned out to be much less expensive than even renting enough computers. Using computer rooms at the university was unfortunately not possible because the University of Bern, in line with most other universities, is currently reducing the number of available computer rooms as most students bring their own laptop computer to class. Secondly, we felt that computer tablets with touch screen would actually make the use of the digital software easy for the students.

The interface of the software was completely based on a web browser and was hence also easy to implement. It offered two different views for the students: an overview of all questions where colors indicated the questions partly or completely answered (FIGURE 6.8), as well as the view of a single question with check boxes to tick for each statement (FIGURE 6.9). Since navigation within a paper exam is generally easier than on a computer screen, we tried hard to present fast and easy to use navigation tools. In the question view, students were able to jump to the previous and next question by pressing appropriate icons. In addition, students could always go back to the overview page and select any question from there. In order to provide the students with an easy system to revisit questions, each question could be flagged individually, and flags were shown on the overview page.



**FIGURE 6.8** Screenshot of the overview page as presented to students:

*On this page, the students were able to see all question of the current part with colors indicating the status of each question. This view signaled that all questions have been answered as all questions appear in blue. Questions not yet answered would show up in gray, those that are only partially answered in red. Students were also able to flag questions in which case a little flag would appear on the square (as shown for question 7).*



**FIGURE 6.9** Screenshot of the question page as presented to students:

*This was how questions were presented to the students. An important design aspect was to split the stem of the question and the statements to evaluate into different panels. This allowed the students to navigate longer stems with multiple images easily, while at the same time focus on an actual statement to evaluate. By pressing the flag icon, questions could be flagged and de-flagged. The arrows in the navigation pane below allowed jumping to the previous or next question without passing through the overview view, which was obtained by pressing the icon displaying a grid. Students were further able to increase the font size, as well as to hide the title and navigation bars by pressing the IBO 2013 logo on the lower right, in which case the navigation arrows would appear next to the flag icon. Answers could be changed arbitrarily many times.*

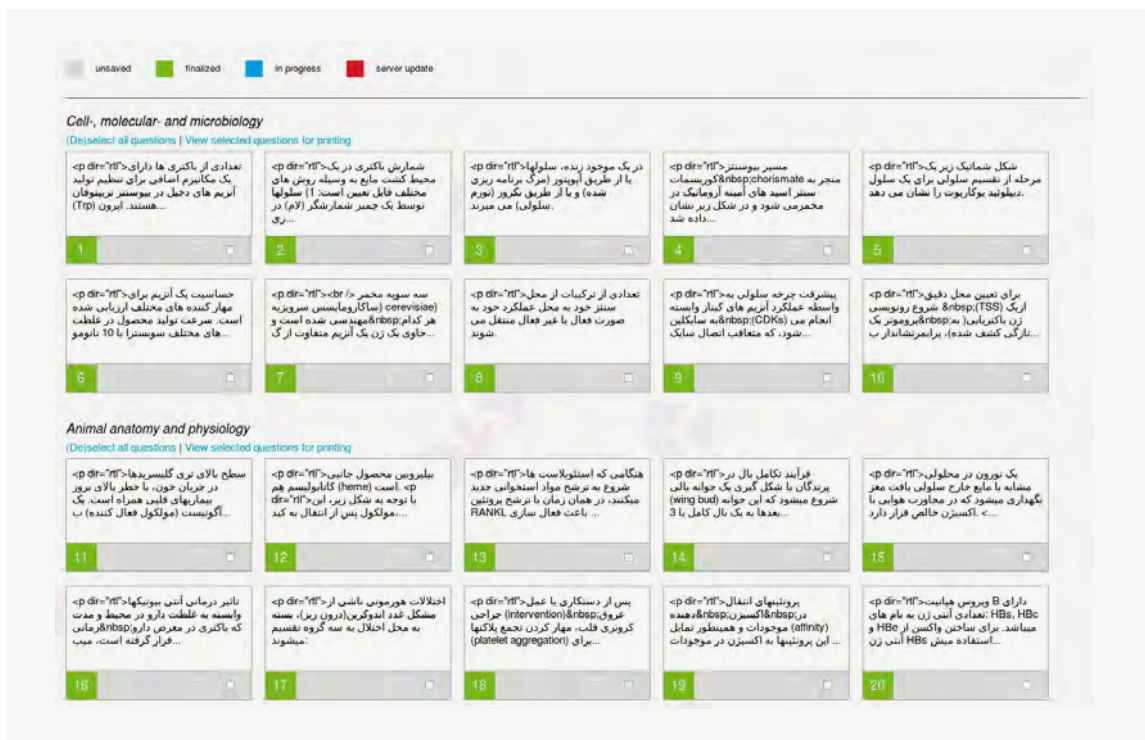
Since figures could take up a lot of space, all figures were initially presented in a reduced size. By pressing on a figure, it would enlarge up to the total width of the left panel. Pressing the figure again made the figure shrink again. In addition, students were able to zoom in and out the whole page using two fingers.

When starting an exam, students had to identify themselves with individual passwords they received on the spot. After successful login, the overview page was shown, but the individual question could not yet be reached. Once all students were successfully logged in, the right to see questions was given to all students. Once the exam was over, students were no longer able to change any answer by blocking that right.

## Jury Views

The use of computer tablets with a predefined layout for each question made it possible to build a simple translational system for the jury. Similar to the students, the jury was shown two different views: one with the overview of all questions indicating the status of translation (FIGURE 6.10), and a second with all text snippets in need of translation with adjacent text boxes to translate into (FIGURE 6.11). The system boosted four major advances over the traditional translations done in a word processing software. Firstly, collaboration among different

jury members was straight forward as any number of people could work on the same exam (but different questions) at the same time. jury members could themselves create language sets and invite others to join their translation effort. This was important since several delegations translate to multiple languages and collaborate with other delegations where possible.



**FIGURE 6.10** Screenshot of the overview page as presented to the jury:

*For easy navigation, this overview displayed an excerpt of each question, together with a color indicating the status of the translation. Questions that were finalized were shown in green, untranslated ones in gray and those in progress in blue. Questions that were changed during the jury discussion but that had already been translated showed up in red. Each question could further be flagged to assist in revisiting particular questions and flagged questions were shown with a highlighted flag icon. Finally, questions could be selected and selected questions presented in a view for easy printing ( PDF or paper ).*

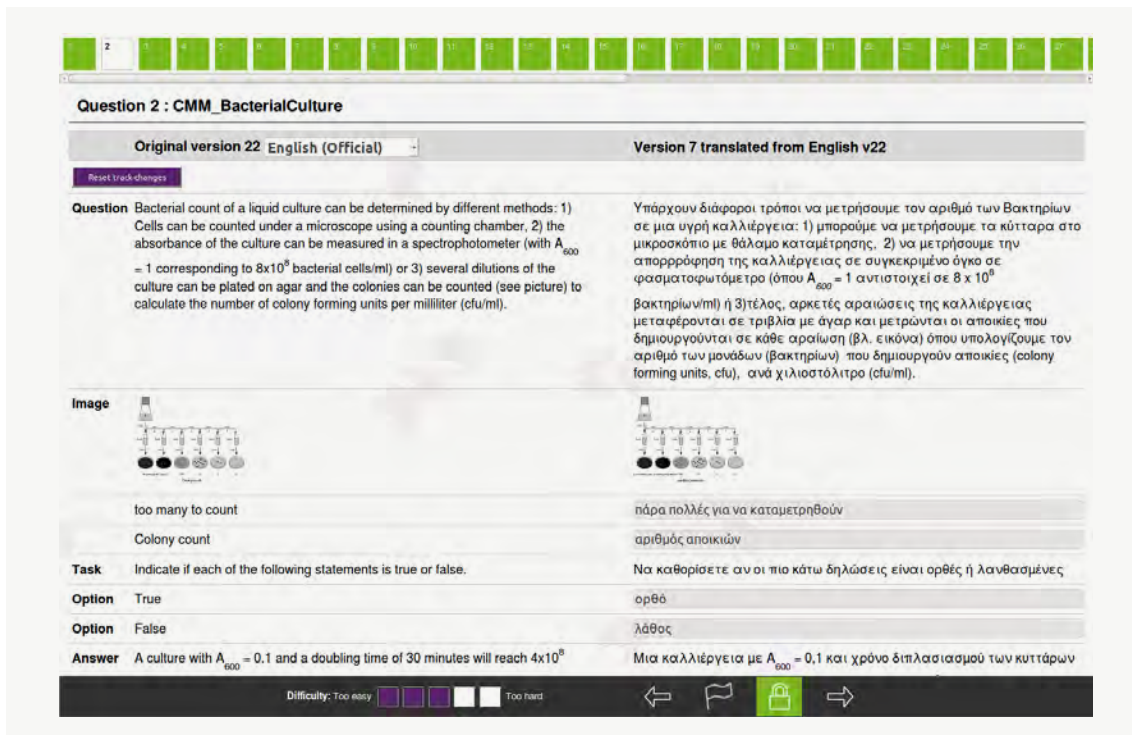


FIGURE 6.11 Screenshot of the translation page as presented to the jury:

On the translation page, the jury was presented with all text snippets in need of translation for a specific question. Changes in the original text since translation were shown using markup (same as in discussion view – see below). Next to it (right side), boxes were placed for the actual translation. When typing inside a box, buttons for using bold or italic font or using sub- or superscript were shown. Text in figures was also presented as snippets that could be translated in the same fashion. The original and translated figure was shown for reference. The language displayed on the left could be chosen freely and text could be copied from the displayed language using a specific bottom. On top of the page, the jury was shown a navigation bar that allowed to quickly jump to a specific question. On the bottom, a navigation was shown that allowed jumping to the previous and next question, to flag a question (flag icon), to finalize a question (lock icon) as well as to rate the difficulty of a question.

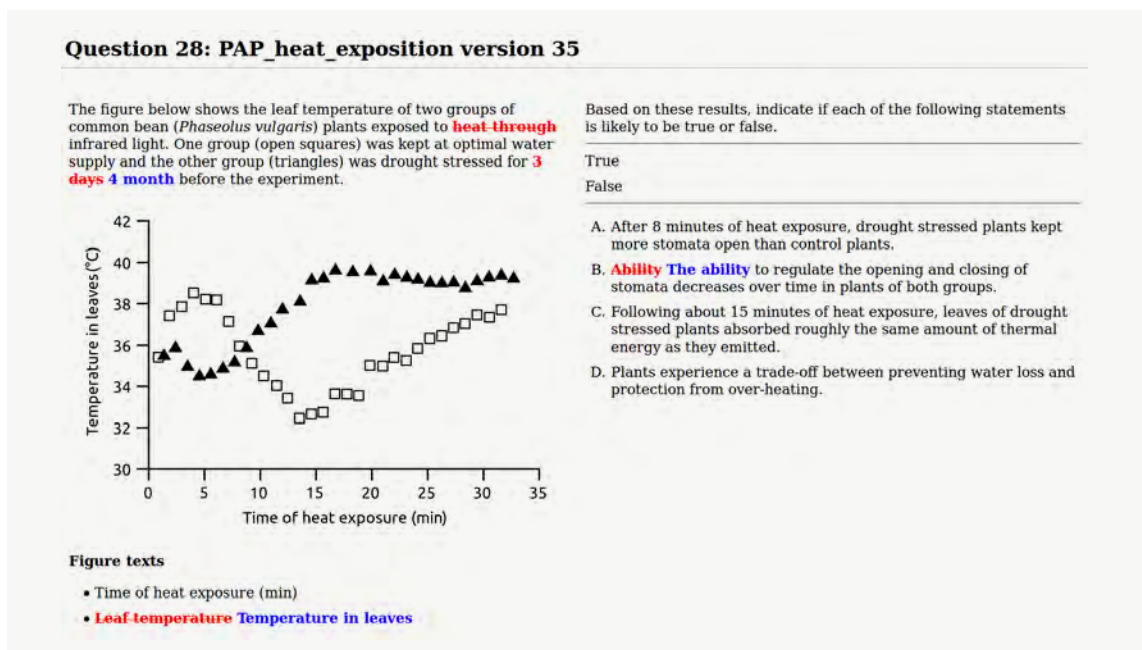
Secondly, there was no need for layout questions. Rather, each question was presented as a series of snippets such as a stem text, figures, the actual question and the individual statements. Each snippet corresponded to a specific place in the layout for the students.

Thirdly, all texts used in figures could be translated just the same way. To ensure that, all figures were prepared in the scalable vector graphics (SVG) format, which is essentially a XML file containing the collection of objects making up the figure. This allowed us to replace the text inside figures based on the translation before presenting them to the students. Since all figures were vectorized, it also guaranteed for a sharp display at any size.

Furthermore, the system implemented a versioning system for each question. Whenever a question was changed, a new version was stored. The biggest advantage of this was that together with the translation of a specific question, it was also saved based on which version of the question had been translated. This then allowed to highlight questions that had been changed after



they were translated and to show the changes that were made to the original since translation (FIGURE 6.10). In addition, it allowed the jury to check all changes made during the discussion at any time. Finally, the system also allowed us to build an easy system to display proposed changes during jury discussions. To be specific, we prepared a view that displayed all changes since the last committed version using a color scheme (FIGURE 6.12). Any proposed changes were typed in by our staff and immediately displayed on the screen. Once the jury agreed on a specific version of a question, all changes were committed and were immediately available to the jury.



**FIGURE 6.12** View used on screen during discussions:

*During the jury discussions, a question was shown on a wide screen with all proposed changes shown using markup.*

## Ensuring Security

Since all these operations passed via the internet to a server, the security of the system was a major concern that we took very seriously. To safeguard ourselves from a potential server failure, we rented two servers in different location in Switzerland that were synchronized. This guaranteed that the failure of one server or a power failure in one part of the country would not interrupt the jury session or the exam itself. To protect the exam questions from reaching the students, the server was configured to only accept traffic from the facilities within which the jury sessions were held. During the exams, traffic was only accepted from within rooms of the University of Bern to make sure that outsiders were not able to login in as students. In addition, each tablet was configured to use a specific wireless network set up by the university, which would only allow the tablet to contact our own server over the internet, but no other computer.

## 6.2.4 Statistical Analysis

### Marking Scheme

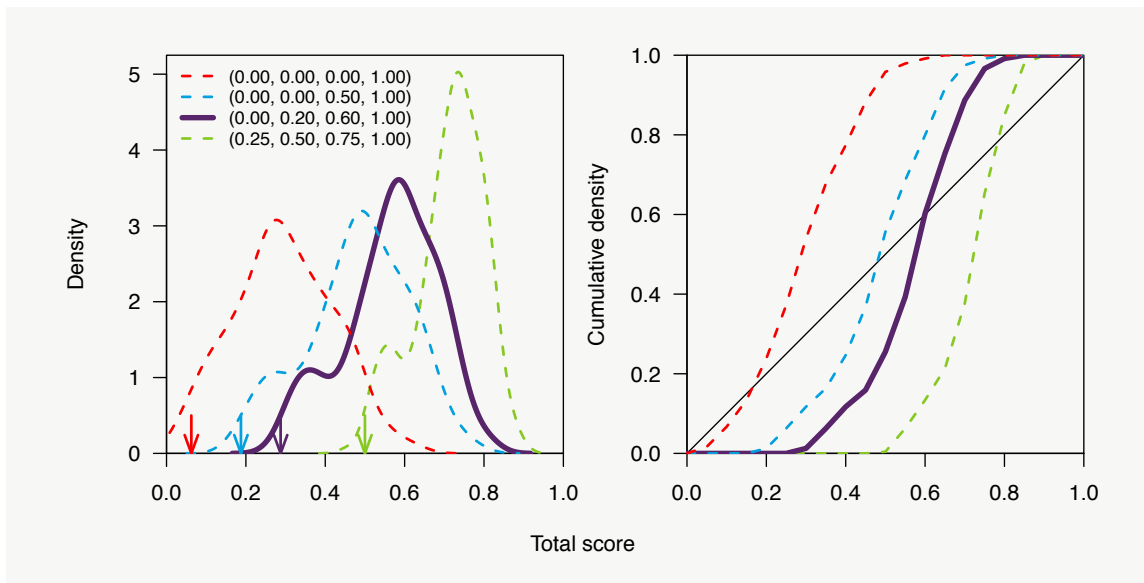
Since it is expected that even by unguided guessing two out of the four statements are on average correct, different marking schemes were initially considered; among them the harshest scheme in which students would only get points when all four statements were answered correctly, and the mildest scheme, under which students would obtain 0.25 points per correctly answered questions. Based on recommendations from the Institute of Medical Education of the University of Bern, we originally planned to use the same scheme that is used in nationwide exams for medical students. Under this scheme, students would obtain a full point if all four statements were correctly evaluated and 0.5 points if three out of the four statements were evaluated correctly. This method was shown to result in the largest score distribution and the highest reliability in medical exams in Switzerland.

After a long and interesting discussion, the international jury decided to go for a milder grading scheme where 1, 2, 3 and 4 correctly evaluated statements would lead to 0, 0.2, 0.6 and 1 points. In addition, it was decided to use the points obtained by the students after the IBO to investigate the effect of different ranking schemes.

As expected, both average and variance of the total scores differ between marking schemes with harsher marking schemes showing a lower average score, but a large variance across students (FIGURE 6.13). We used various statistics to test if the increased variance for harsher marking schemes is informative about differences between students or just stochastic, all of which reported in TABLE 6.2. Interestingly, the marking schemes turn out to be all extremely similar in all aspects, suggesting that any of the two intermediate marking schemes is equally appropriate to be used.

Scheme	Cronbacher $\alpha$	Kolmogorof-Smirnov test statistics for uniformity	Correlation with Practical Exam ( $\rho$ )
0.00, 0.00, 0.00, 1.00	0.89	0.19	0.78
0.00, 0.00, 0.50, 1.00	0.92	0.16	0.79
0.00, 0.20, 0.60, 1.00	0.93	0.19	0.79
0.25, 0.50, 0.75, 1.00	0.93	0.26	0.80

TABLE 6.2 Effect of marking schemes.



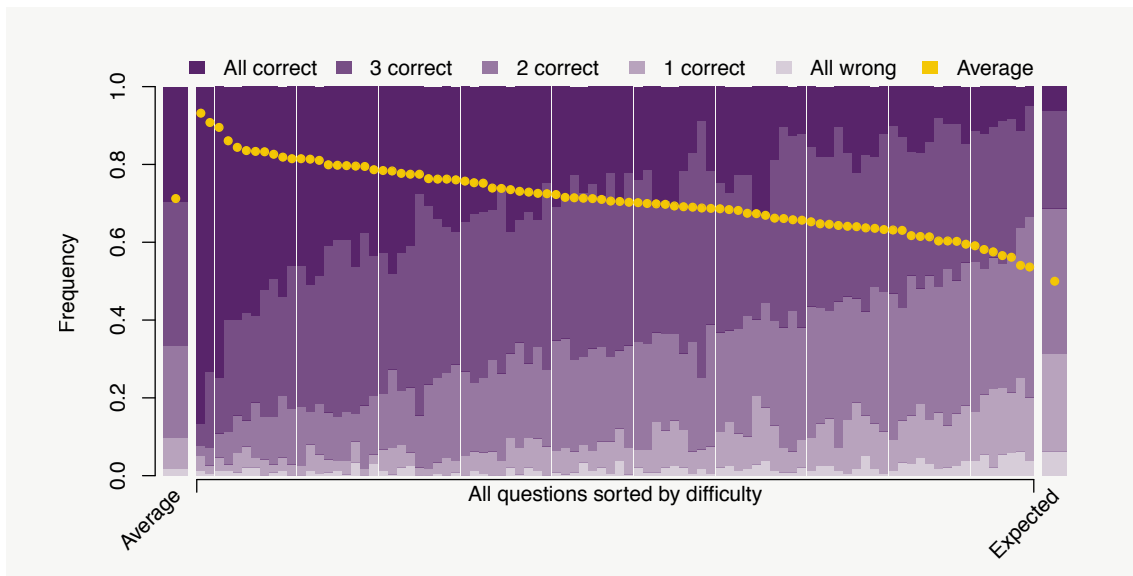
**FIGURE 6.13** Distribution of scores:

*The actual (left) and cumulative (right) distribution of points obtained by the participants are shown for different marking schemes. The schemes differ in the number of points attributed to 1, 2, 3 or 4 correct answers per question (see legend) with the actual marking scheme used in the IBO 2013 shown in purple, the only originally proposed by the organizers in blue and the harshest and mildest marking schemes possible in red and green, respectively. The points were standardized such that 1 corresponds to the maximum number of points that could be obtained in the exam (92, regardless of marking scheme).*

### Total Scores and Difficulty

In line with the results of previous IBOs, the theoretical exam proved to be rather difficult, regardless of the marking scheme. Under the marking scheme used for the IBO 2013, the median relative score was 0.58 (standardized such that 1 corresponds the maximum attainable number of points). While one student obtained a score (0.27) slightly below the relative score expected for students guessing every item (0.29), the highest score obtained was only 0.8152. For comparison, an ideal exam would show a median value of about 0.64 (in the middle of 0.29 and 1) with the individual scores distributed uniformly between 0.29 and 1.

The overall difficulty of the exam is confirmed when analyzing the distribution of correct answers given by the participants for each question individually (FIGURE 6.14). While we found the questions to show varying degrees of difficulty, there is an apparent lack of easy questions with very few questions showing an average above 0.8. It thus suggests that a more reliable ranking would be obtained by using questions that were slightly easier on average. On a bright side, even the most difficult questions were still solved better than expected if students were only guessing.

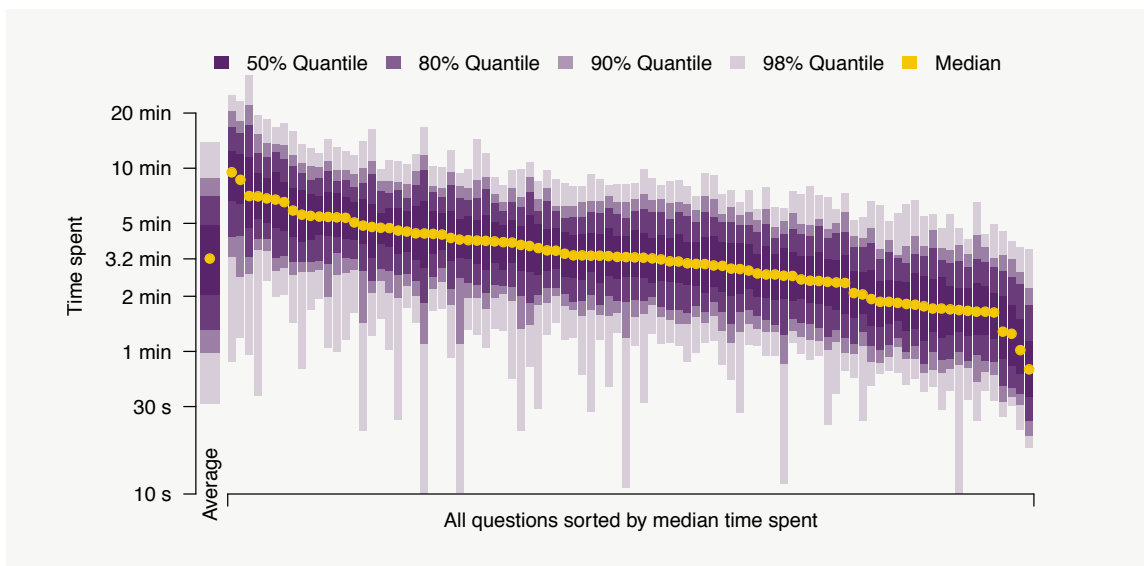


**FIGURE 6.14** Difficulty of individual questions:

For each question, the fraction of students evaluating 0, 1, 2, 3 or all 4 statements correctly is shown, along with average number of correct statements (yellow dot). Questions are sorted by decreasing average. For reference, the average distribution across all questions is shown on the left and the expected fractions when all students would have simply guessed the answer on the right. While the questions do show varying degrees of difficulty, there is an apparent lack of easy questions with very few questions showing an average above 0.8.

### Time Spent on Exam and per Question

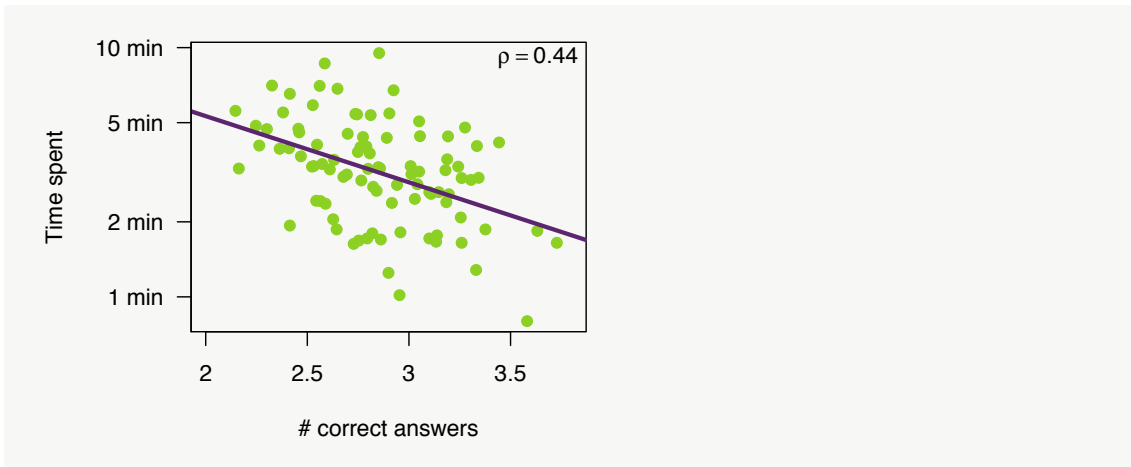
During the theoretical exam, each individual click of a student was recorded. This allows for an unprecedented analysis of the students' performance and their strategies during the exam. It allows us, for instance, to calculate the time spent per question for each student individually (FIGURE 6.15). On average, the participants spent 3.2 minutes on a question, which is considerably faster than the 4.6 minutes available to them (420 minutes for 92 questions). However, the time spent varies considerably between questions, with some questions solved by most students in less than 2 minutes and others for which most students spent more than 5 minutes.



**FIGURE 6.15** Time spent per question:

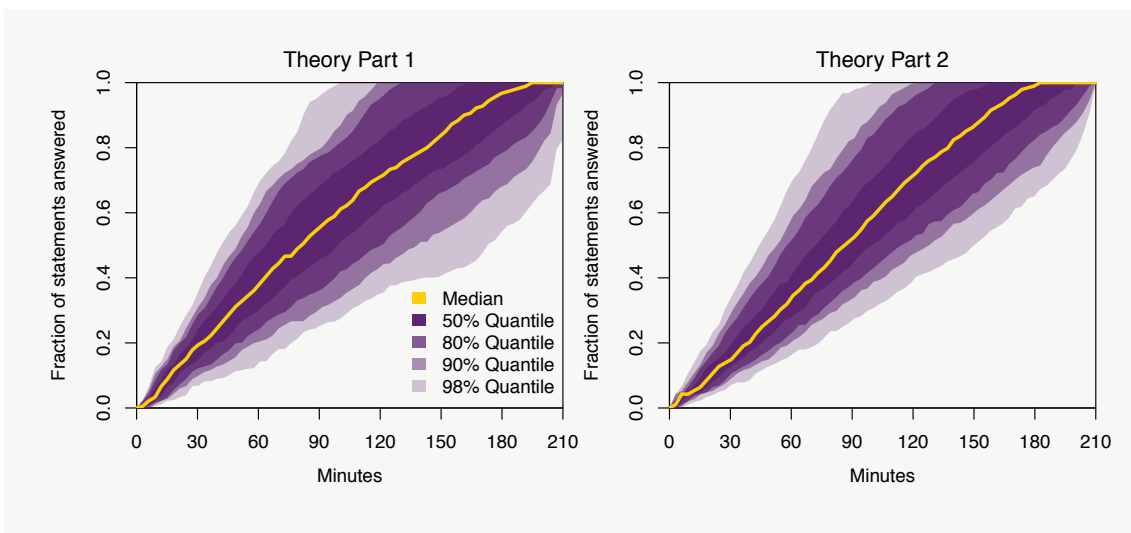
*Shown are the distributions of the times spent for each question, sorted by decreasing median time. If a student visited a question multiple times, the total time spent on that question was calculated as the sum of the individual times. For comparison, the distribution of the average times per question is shown on the left, calculated as the distribution across all questions.*

There was also considerable variation in the time spent by individual students with some of them spending more than ten times as much time than others on the same question. While some students were clearly faster than average on some questions and slower than average on others, the data suggest some variation in overall speed between the students with the 10% fastest students spending less than 3.2 minutes on average per question, and the slowest 10% more than 4.3 minutes. As a result, students varied greatly in the speed with which they progressed through the exam, with some of them having answered all questions in less than half the time provided and others in need to rush towards the end (FIGURE 6.17). Interestingly, students progressed more similarly in the second part than the first, due to the slowest students performing better. While there is no direct evidence, we believe this to be due to students being more familiar with the system and, potentially, students struggling with the first part of the exam running over lunch time (until 13:48) since students tended to slow down during the first part.



**FIGURE 6.16** Difficulty is only weakly correlated with total time spent:

*Shown is the average number of statements evaluated correctly versus the average time spent on that question (on a log scale) for each question.*



**FIGURE 6.17** Progress as a function of time:

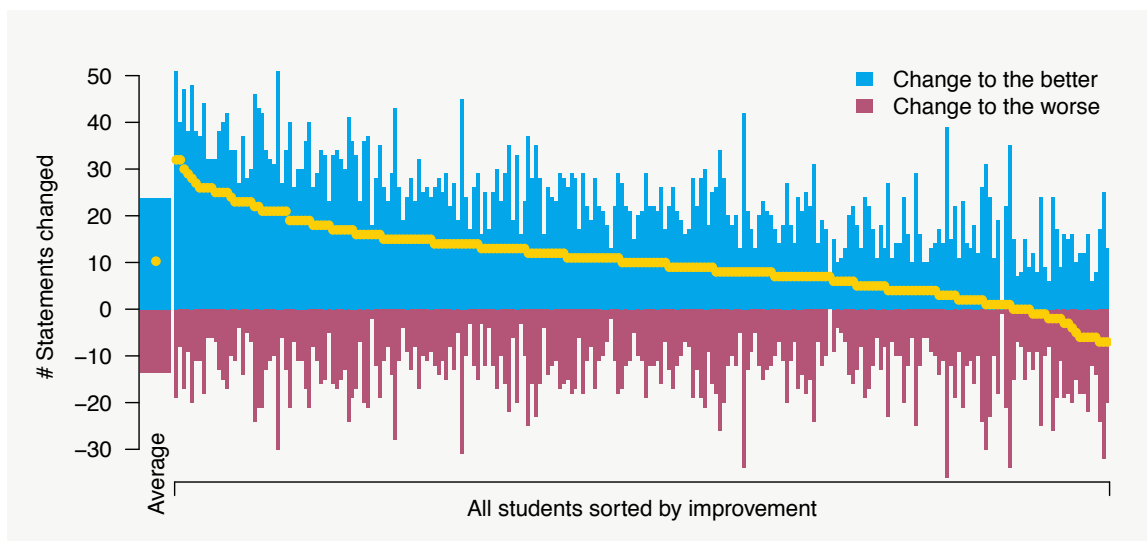
*We measured progress as the fraction of all statements each student already evaluated. Shown is the distribution of this fraction as a function of time for both parts of the theoretical exam.*

We originally planned to run the exam for 6 hours (3 hours per part), but the international jury voted on Wednesday to extend the time to 7 hours to give more time to the students. It is thus interesting to see what this additional hour meant for the students. Based on the average time per question, we can estimate that about 45% of the students would have finished the whole exam in 6 hours. In line with this estimate, 37% and 47% of all students evaluated all statements in the first 3 hours in the first and second part of the theoretical exam, respectively. These numbers are likely underestimated since the slower students picked up in speed considerably during the last half hour of the exam, which they are expected to also do if the exam was shorter. Nonetheless, this data suggests that about half of the students benefited from the extended time.

The same data can also be used to ask how long the exam should have been in order to allow 90%, 95% or all students to finish at their speed. To do so, we estimate the average time spent per question only from the first 3 hours of each exam, and thus ignoring the last half hour during which the students progressed at an elevated speed. The corresponding estimates are 7.1, 7.9 and 10.4 hours. Using this estimate of individual speed, more than 85% of all students were able to finish at their speed in the 7 hours provided, suggesting that the time provided was sufficient.

### Switching Answers

We next looked at how often students changed their mind regarding an answer and whether their later changes were on average for the better or for the worse. Here, we define a change as a difference between the first and last answer provided, and hence ignore cases in which students changed back and forth, but eventually returned to the first answer provided. Under this definition, the average student changed the answer at 37.4 statements, corresponding to 10.2% of the total exam. Of these, 63.8% were a change to the better and hence only 36.2% to the worse. However, there was a large variation across the students in both the number of statements for which the answer was changed, as well as for the net benefit of these changes (FIGURE 6.18). Nonetheless, 214 or 89.5% of all students more often changed to the better than to the worse and only 20 or 8.4% of the students reduced the number of correctly evaluated statements due to revisiting statements.



**FIGURE 6.18** Benefit of revisiting the answer:

*We compared the first and last answer given for each question for each student and report here the total number of statement changed to the better (changed to the correct answer, blue) and the total number of statements changed to the worse (changed to the wrong answer, purple). From this, we calculated the net benefit of all changes (yellow dot) and plot the students regarding their net benefit in descending order. In total, only 8.3% of all students lost points by changing answers, while 89.5% gained.*

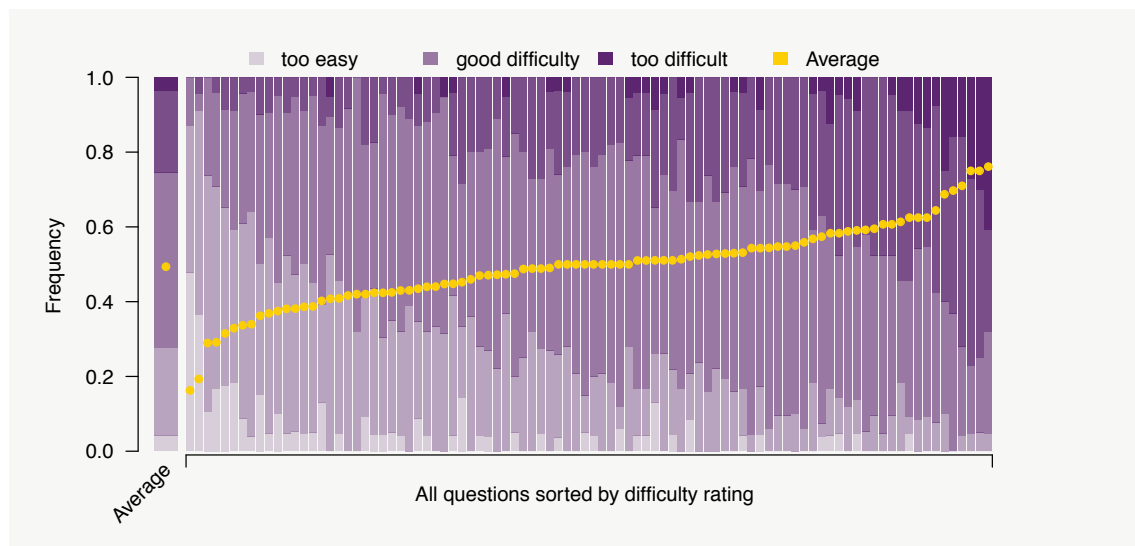
## The Use of Different Languages

The students had the possibility to switch between languages during the exam and the system actually recorded the total time spent in each language. This data clearly suggest that the most commonly used language was English, used in 30.7% of the total time spent (time \* number of students). Interestingly, this is not only due to the large number of students only working with the English version (40 students or 17%), since 44 of the remaining students (18% of all students) used the English version in more than 30% of their time. In addition, these are likely underestimates since several delegations provided the English text in line with their translation.

The next most often used language was Russian (8.2% of the total time), followed by Spanish (5.0%), Turkish, German and Greek (all ~2.9%), Arabic (2.5%) and Dutch (2.0%). As comparison, a language used by a single team of 4 students should make up 1.7% of the total time.

## Prediction of Jury Regarding Difficulty

During the jury sessions, each delegation was asked to rate each question regarding its difficulty on a five level scale where 1 corresponded to a too easy question, 3 to a question of appropriate difficulty and 5 to a too difficult question. On average, about 22 or 1/3 of all delegation rated each question (range spanning from 17 to 27). Based on this data, it appears that the jury was rather happy with the difficulty: the average rating corresponds to 2.97 and 47.8% of all questions received an average rating between 2.75 and 3.25 (FIGURE 6.19). Interestingly, the judgment of difficulty spanned at least four out of the five levels for every question with less than 50% of the jury agreeing on the same difficulty for more than 52% of the questions. Nonetheless, the questions differed considerably in their average difficulty as ranked by the jury with the easiest question getting an average score of 1.65 and the most difficult a score of 4.05.

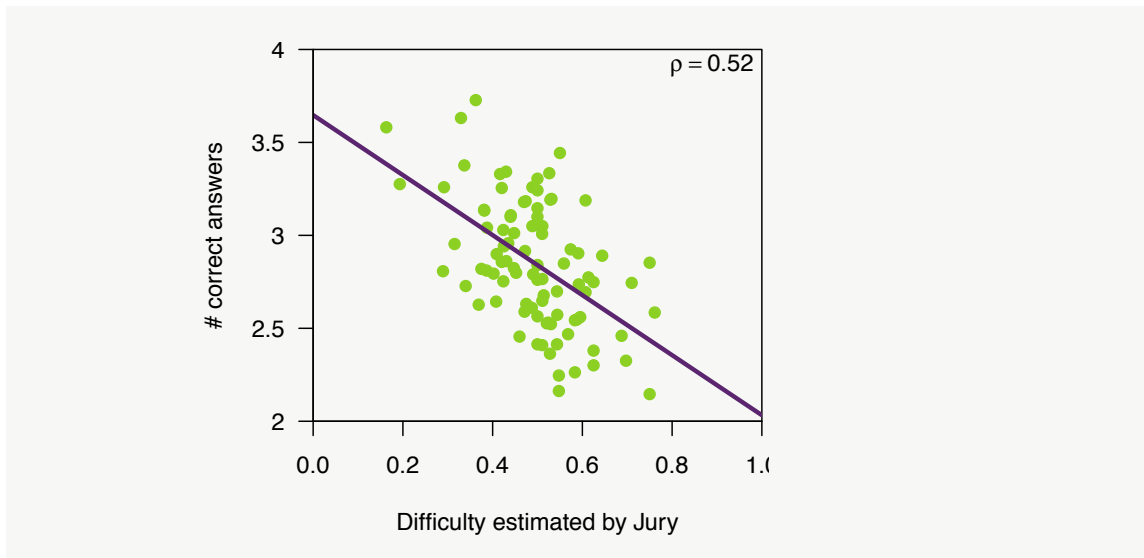


**FIGURE 6.19** Difficulty estimated by the jury:

*During the jury sessions, each delegation was asked to rate the difficulty of each question on a scale of five levels ranging from “too easy” to “too difficult”. Shown here is the distribution of obtained ranks for each question, with the question sorted by increasing average difficulty. For comparison, the average distribution across questions is shown on the left. Yellow dots correspond to the average difficulty per question.*



Interestingly, the actual difficulty (measured as the average number of statements correctly evaluated by the students) was only rather weakly correlated with the difficulty as rated by the jury ( $\rho=0.52$ ,  $p=0.01$ , FIGURE 6.20). Nonetheless, the jury was actually rather accurately predicting the most difficult and most easy questions, but questions of average difficulty were rated with a large degree of uncertainty.



**FIGURE 6.20** Weak correlation between difficulty estimated by the jury and actual difficulty of questions:

*Shown is the average difficulty as rated by the jury (x-axis, 0 corresponding to a too easy and 1 to a too difficult question) against the average difficulty of a question as measured by the average number of correctly evaluated statements across all students (y-axis) for each question, together with a linear fit to the data.*

### 6.2.5 Reception of the Theoretical Exams

The theoretical exam was rated to be of very high quality as 80% of the jury gave the quality of the exam a mark of 4 or 5 out of 5 with an average rating of 4.04 in a survey conducted after the IBO (Chapter 7). In contrast, the students ranked the theoretical exam to be too difficult with an average score of 3.82 out of 5 (3 being appropriate difficulty).

Astonishingly, the jury was also very happy with the use of computer tablets with 78% choosing a mark of 4 or 5 out of 5 and an average rating of 3.99. This suggests that future organizers should be advised to use similar means of testing. It is to note, though, that 8.7% of the jury members did not approve the use of computer tables.

Finally, the jury seemed also very happy regarding how the jury sessions were organized. In total, 78.3% of all jury members appreciated the extended time, with an additional 15.9% being OK with it. Only 5.8% of the jury members were not happy with the extended time. The best marks, however, were obtained for the overall organization of the jury session, which was marked favorably by 78% of all jury members with an average score of 4.15 out of 5. All results to be found in Chapter 7.

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## Compiling the Final Ranking

As described in Chapter 6.1.4, an additional jury session had to be organized for Saturday morning, to verify our marking. As a result, it was impossible to hold a session to discuss the final ranking with the jury. We, the organizers, thus asked the jury on Friday to be trusted in handling the compilation of the final ranking, which we were granted with tremendous support.

The compilation of the final ranking is described in the rules as follows:

- “The final ranking of the students is based up on their equally weighted scores for theory and practical tasks according the t-score method. This is achieved in taking the average of the four t-scores of the practical task and taking the t-score of the total result of the students on both theory parts. The final score is the sum of these two. Applying a not equal balance between theory and practical task requires the approval of the International Jury.”

The rules clearly state that the t-score procedure should be used to enforce an equal weighting between the two parts. The t-score method consists of two steps. In a first step, t-scores of the two exams have to be standardized to equal variance (note that unequal means do not affect the weight of the exams). The standardized values are then combined to build the final score.

However, the rules erroneously assume that taking the average of the standardized practical scores (the practical t-score) would lead to a standardized practical score. Since the scores obtained in the practical exams are not perfectly correlated, the sum of the practical t-scores is always expected to have a variance less than 1, even when the variance has been standardized to 1 for each practical individually. In the case of the IBO 2013, the actual variance of the sum of the t-scores was only 0.7. Applying the formula given in the rules would hence have led to a much larger relative weight of the theoretical exam. However, a proper application of the t-score method does require a re-standardization of the sum of the practical scores to obtain equal variance and hence equal weight of the theoretical and the practical exam.

The rules are therefore contradictory in that they vigorously demand an equal weighting of the theoretical and practical exam, while the described procedure does always lead to an uneven weighting, unless the practical scores are perfectly correlated. As a result, we were actually not able to satisfy the rules in their entity and were hence faced with the challenge to either break the requirement for equal weighting, or apply a different formula than stated in the rules. Convinced that the spirit of equal weighting is more important to the majority of the jury than an application of the formula by the book, we went for the second solution and hence added an additional standardization step for the average of the practical scores. While heavily discussed, we finally got the full support of the AB meeting in Bangkok, November 7/8, 2013, for this decision.



**TOP** Jury at work, using the newly implemented translation software - jury session.

**BOTTOM** Plant practical: a steady hand and careful examination were necessary.



**TOP** Subgroup work hard to prepare the jury sessions.

**BOTTOM** Tablets are made ready for their use during the exams.



Noémie Jordi, President of the Swiss Biology Olympiad association ibo|suisse, hands over a bronze medal at the medal ceremony.

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# 7. Survey

In order to evaluate the organization of the IBO 2013, the project management had planned to ask all participants for their feedback through a questionnaire. This was also proposed by Gayane Ghukasyan, Armenia, at the Advisory Board (AB) meeting 2012 (November 2-4) in order to collect useful information for future organizers. The proposal was accepted by the AB and Gayane Ghukasyan was entrusted with developing a questionnaire for the IBO 2013.

This questionnaire was thankfully accepted, revised and adapted to the IBO 2013. Some questions have been added (marked further down with an\*). Two separate questionnaires were produced: one for students and one for jury members. All answers ranged from 1 to 5, 1 representing the negative and 5 the positive end of the scale.

In addition to all charts, the average and median of each question is shown. Also, and with exception to the questions concerning the difficulty of the exams, the sum of all answers marked with a 4 or a 5 (i.e. with a good to over the expectation mark) is given to display the percentage of people with a positive answer. For this sum, all “non-answers” were neglected.

The number of written comments on the questionnaires received was unfortunately not high enough or not very specific to be included in this report. A list of all comments can be given on request.

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## 7.1 Students' Questionnaire Results

On Friday evening, July 19 2013, all students were asked to fill in the questionnaire. A total of 171 out of 240 (71.25%) have been returned.

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### 7.1.1 Overview – Students

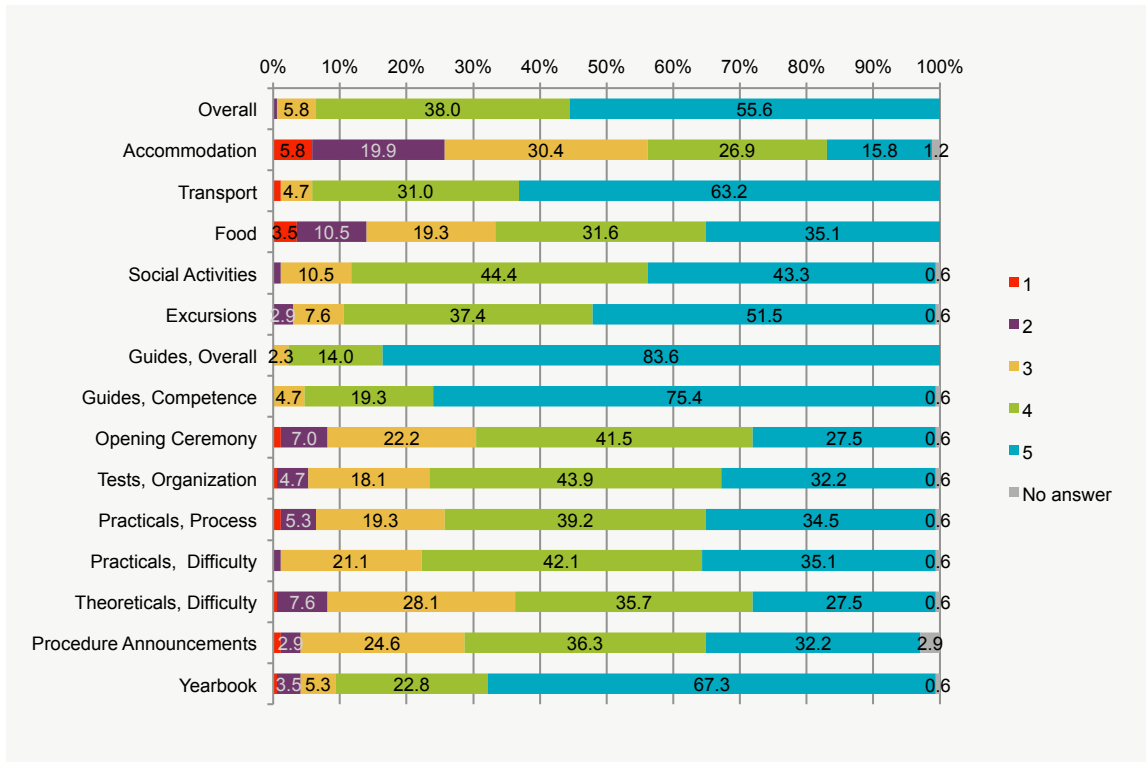
With an average of 4.49 of a total of 5.00 (= Exceeded my expectations), the students feedback on their overall experience of the IBO 2013 was excellent.

The best marks were given to the team guides who accompanied the participants during the entire week. With outstanding 4.81 and 4.71 respectively, their care and competence were marked highest amongst the questions asked. Furthermore, yearbook, transportation and excursions reached also high scores of satisfaction (with average marks of 4.54, 4.55 and 4.38, respectively).

The perception was less positive in regard of accommodation, with an average of 3.27, and food, with an average of 3.84, although the results are still on the positive side of the scale. According to the few written comments given, this was mainly due to the small size of the rooms, allowing little privacy, and to double instead of single beds and no air-conditioning. The food also posed a certain controversy, however with often contradictory comments.

As for the difficulty of the exams, they were marked as 3.82 (theoretical exams) and 4.12 (practical exams), where 1 = Very easy and 5 = Very difficult.

To summarize, the answers were as follows:

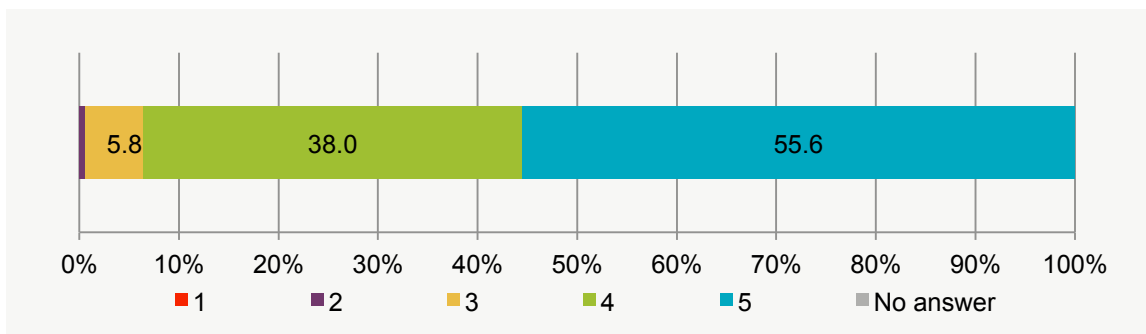


**CHART 7.1** Answers 1 = Negative; 5 = Positive; with exception of questions to the difficulty of the exams, where 1 = Very easy and 5 = Very difficult

### 7.1.2 Details – Students

On the following pages, each question and their results are shown.

#### How did you find the IBO 2013 overall? \*<sup>1</sup>

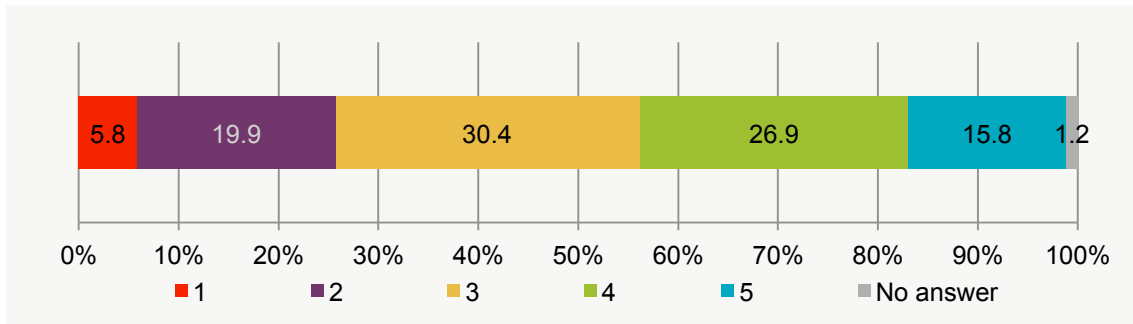


**CHART 7.2** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 4.49  
 Median: 5  
 Percentage of 4 and 5: 93.6%

<sup>1</sup> Questions or partial sentences marked with an asterisk were added by the IBO 2013 organizers to the questionnaire proposed by Armenia.

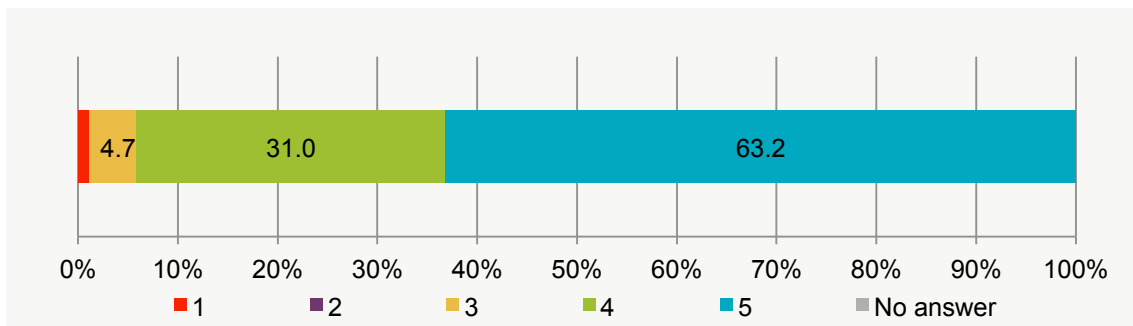
### How would you rate the accommodation at IBO 2013?



**CHART 7.3** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 3.27  
 Median: 3  
 Percentage of 4 and 5: 43.2%

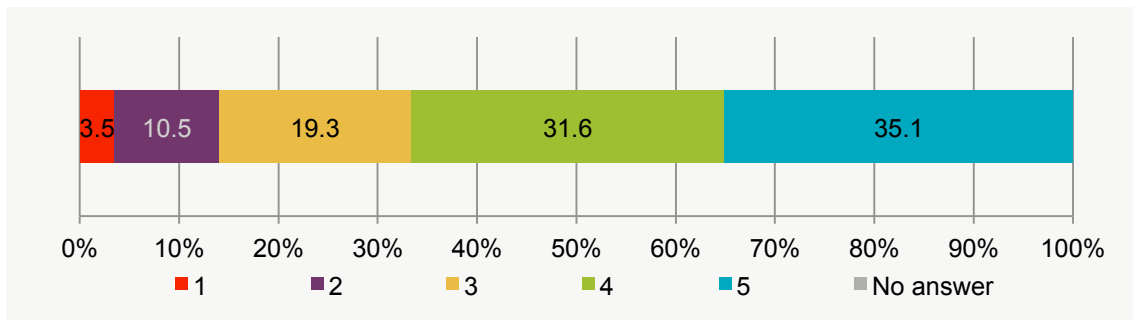
### How would you rate the transportation at IBO 2013? (Please consider especially the wide use of public transportation.\*)



**CHART 7.4** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 4.55  
 Median: 5  
 Percentage of 4 and 5: 94.2%

### How would you rate the food that was served during IBO 2013? Please consider food, as well as dining area, meal arrangement and logistics, etc.

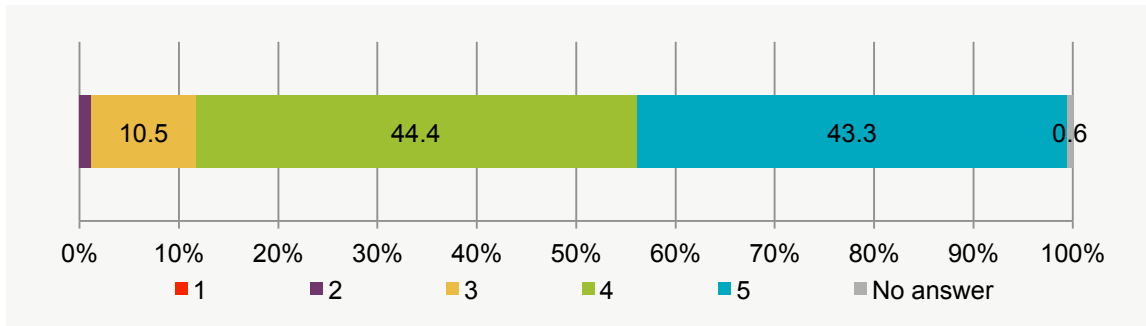


**CHART 7.5** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 3.84  
 Median: 4  
 Percentage of 4 and 5: 66.7%



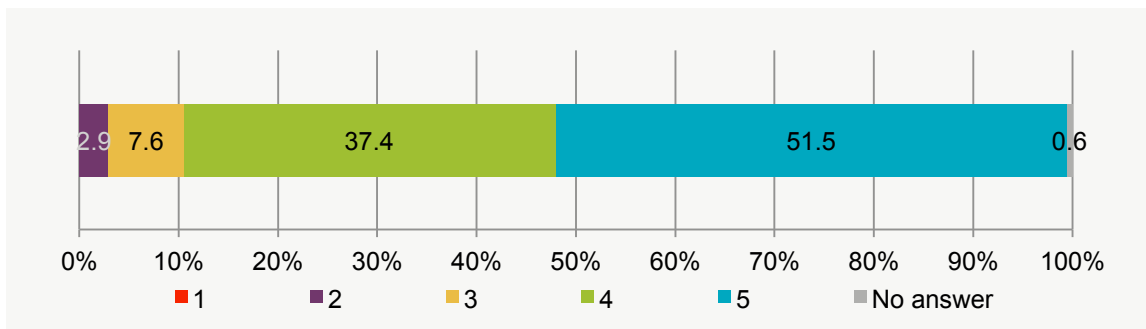
### How would you rate the social activities at the IBO 2013?



**CHART 7.6** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 4.31  
 Median: 4  
 Percentage of 4 and 5: 88.2%

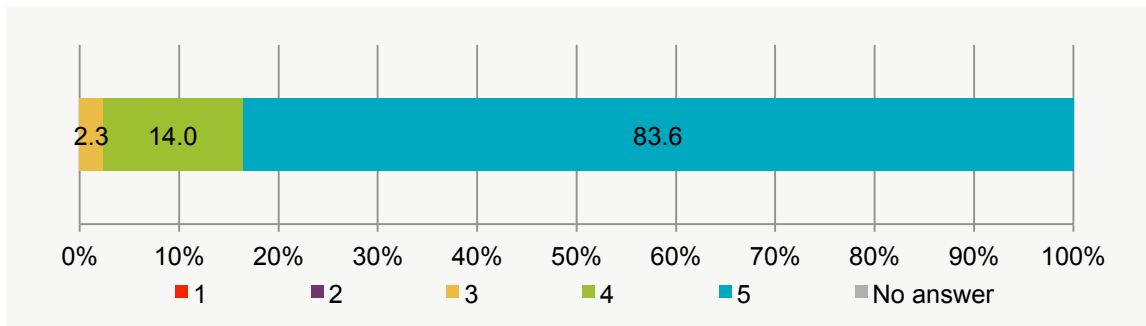
### How interesting did you find the excursions?



**CHART 7.7** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 4.38  
 Median: 5  
 Percentage of 4 and 5: 89.4%

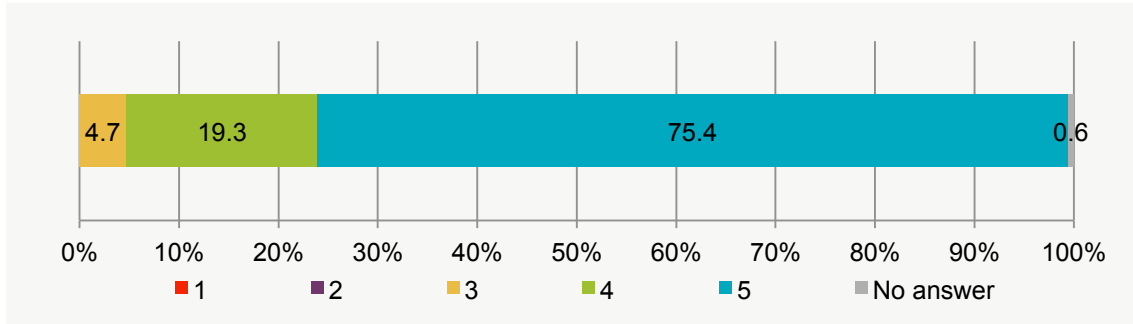
### Please rate the guides who were accompanying you during the IBO. (How did the guides care for you during the IBO?\*)



**CHART 7.8** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 4.81  
 Median: 5  
 Percentage of 4 and 5: 97.7%

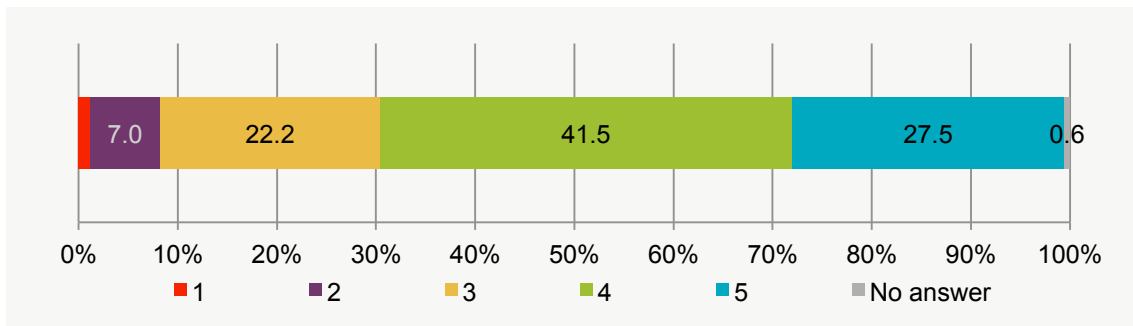
**How competent did the guides seem to be? Please consider if the guides could give you all information needed and desired by you.\***



**CHART 7.9** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 4.71  
 Median: 5  
 Percentage of 4 and 5: 95.3%

**How would you rate the Opening Ceremony at IBO 2013? Please give feedback based on logistics and organization rather than content.**



**CHART 7.10** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

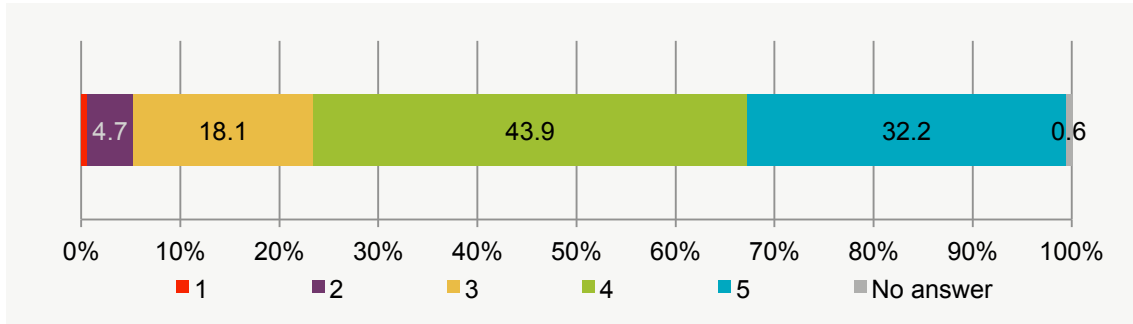
Average: 3.88  
 Median: 4  
 Percentage of 4 and 5: 69.4%



**TOP** The top three winners of the International Biology Olympiad 2013.

**BOTTOM** Scientific Committee co-chairman Prof. M. Taborsky congratulates a bronze medal winner.

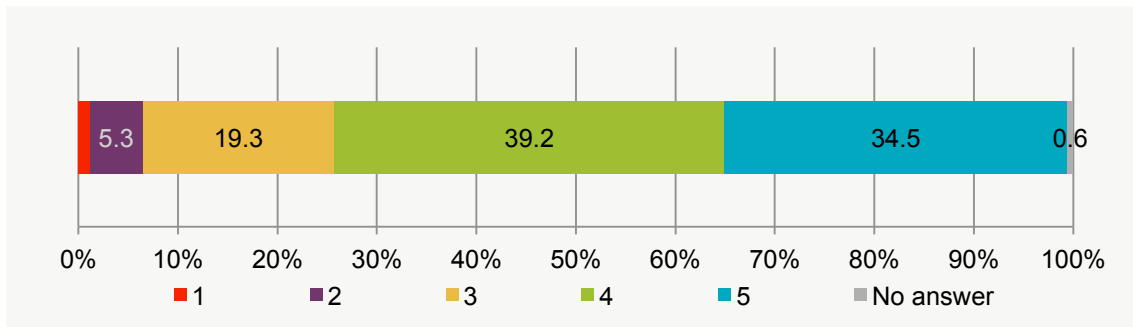
**How well organized was the testing process? Please give feedback based on noise and the comfort of the environment.**



**CHART 7.11** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 4.03  
 Median: 4  
 Percentage of 4 and 5: 76.5%

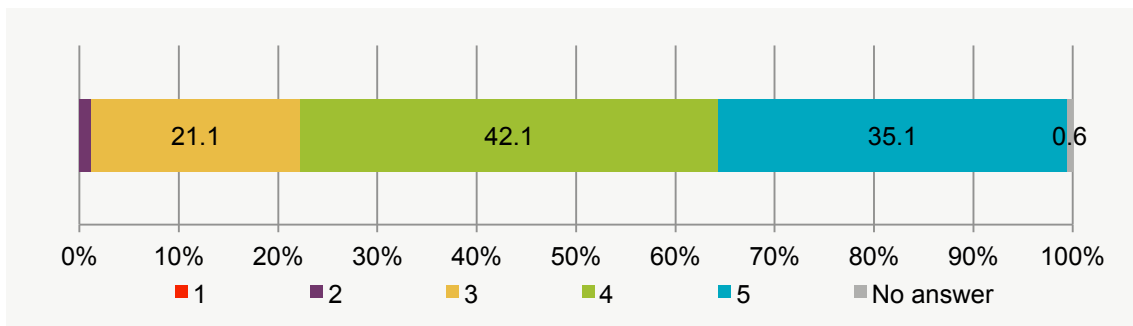
**How was the process of the practical exams? \***



**CHART 7.12** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 4.01  
 Median: 4  
 Percentage of 4 and 5: 74.1%

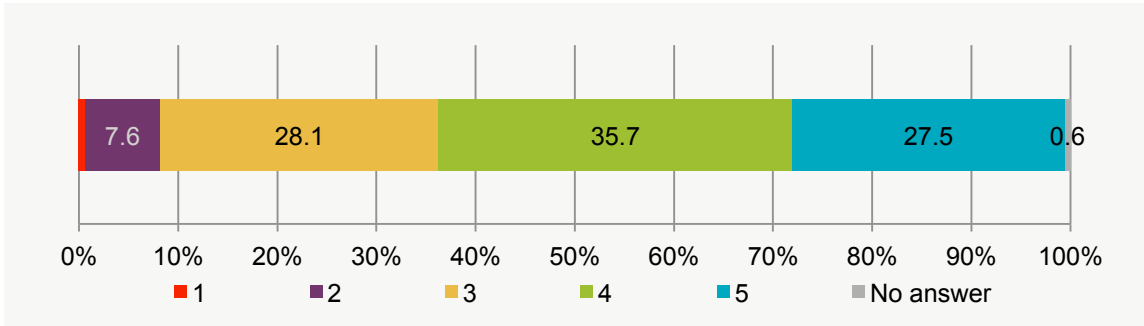
**How would you rate the difficulty of the practical exams? \***



**CHART 7.13** Answers 1 = Very easy; 5 = Very difficult

Average: 4.12  
 Median: 4

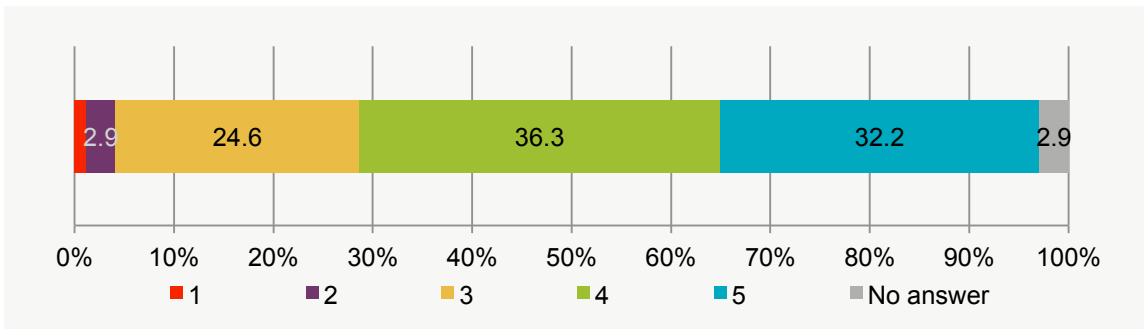
### How would you rate the difficulty of the theoretical exams?\*



**CHART 7.14** Answers 1 = Very easy; 5 = Very difficult

Average: 3.82  
Median: 4

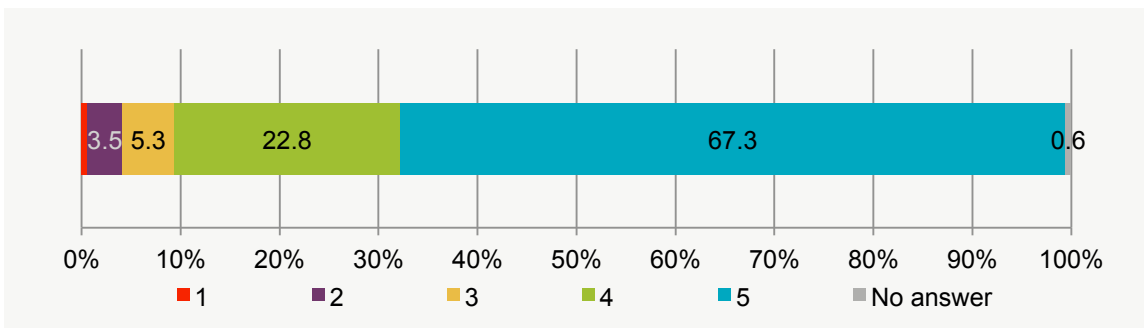
### How useful were the supporters announcing the procedures?



**CHART 7.15** Answers 1 = Useless; 5 = Very good idea

Average: 3.98  
Median: 4  
Percentage of 4 and 5: 70.5%

### How would you rate the yearbook?\*



**CHART 7.16** Answers 1 = Useless; 5 = Very good idea

Average: 4.54  
Median: 5  
Percentage of 4 and 5: 90.6%

## 7.2 Jury's Questionnaire Results

Jury members were given the questionnaire during the excursion on Friday, July 19 2013. Only 69 out of 208 handed it in, which means a return rate of 33.19%. This still can be considered as good but of course, in comparison to the students, the analysis of the results are less relevant.

### 7.2.1 Overview – Jury

With an average of 4.16 of a total of 5.00 (= Exceeded my expectations), the feedback on the overall experience of the IBO 2013 was positive even though not unexpectedly a little less overwhelming than the students'(4.49).

The best marks were given to transportation and excursions (with averages of 4.43 and 4.38, respectively), while the Opening Ceremony received the lowest mark but was still above average (3.68). All innovations or changes compared to past IBOs were on the whole well accepted. Nevertheless, the results reflect a certain controversy as this was an area which also received the highest number of low marks (1):

- Graded fees system: 3.93
- Extra day / timing of the jury sessions: 4.12
- Use of tablets for the theoretical exams: 3.99
- Yearbook: 4.35

All answers at one glance:

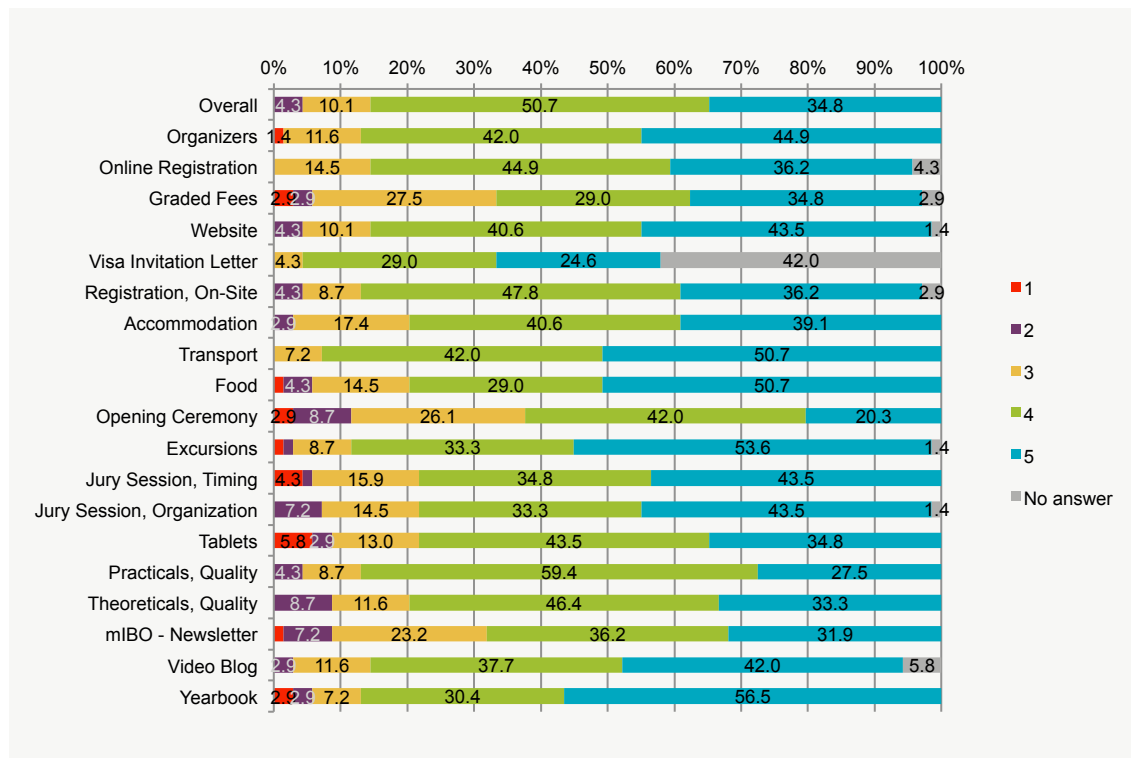
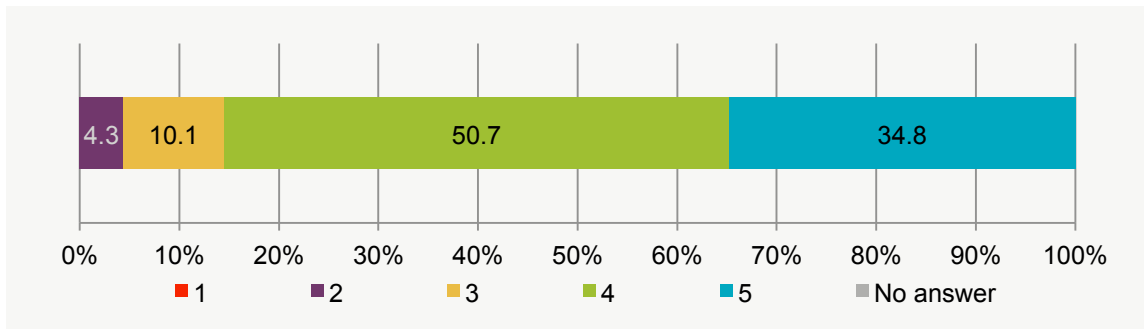


CHART 7.17 Answers 1 = Negative; 5 = Positive.

## 7.2.2 Details – Jury

On the following pages, each question and their results are shown.

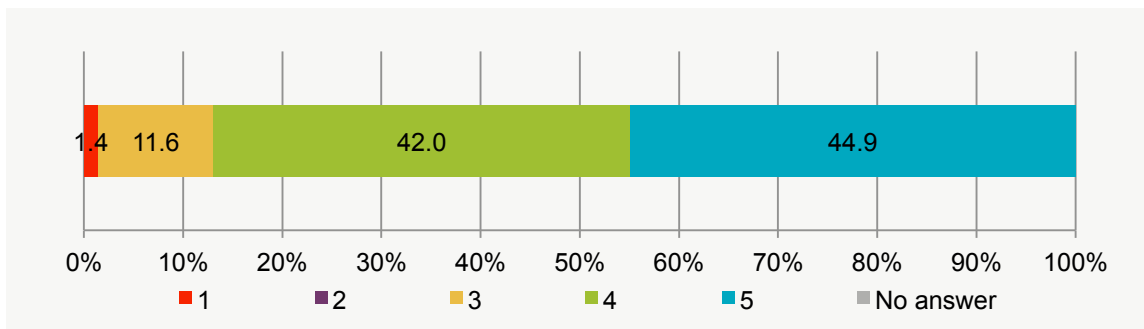
### How did you find the IBO 2013 overall?\*



**CHART 7.18** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 4.16  
Median: 4  
Percentage of 4 and 5: 85.5%

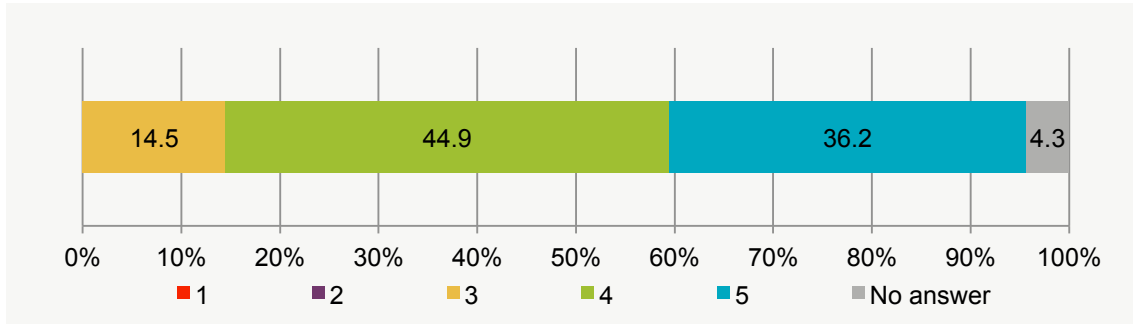
### How courteous and flexible were the organizers of the IBO 2013?\*



**CHART 7.19** Answers 1 = Not satisfactory; 5 = Exceeded my expectation

Average: 4.29  
Median: 4  
Percentage of 4 and 5: 87.0%

### How did you find the online registration process?\*



**CHART 7.20** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 4.23  
 Median: 4  
 Percentage of 4 and 5: 84.8%

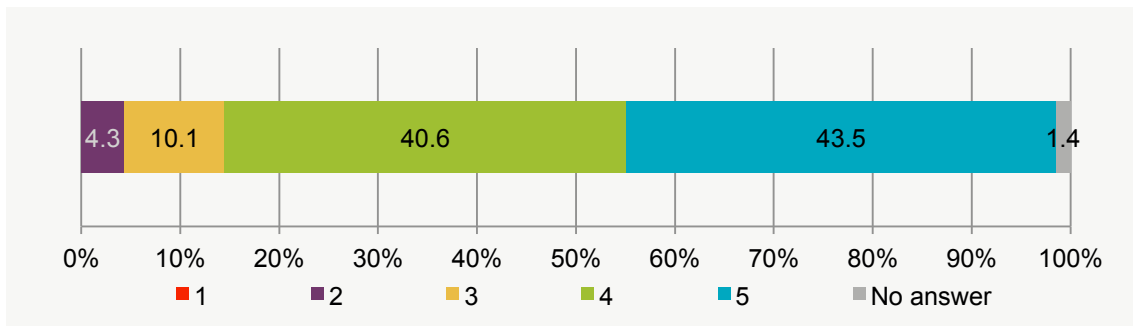
### How did you find the implementation of a graded fees system?\*



**CHART 7.21** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 3.93  
 Median: 4  
 Percentage of 4 and 5: 65.7%

### How did you find the IBO website?\*

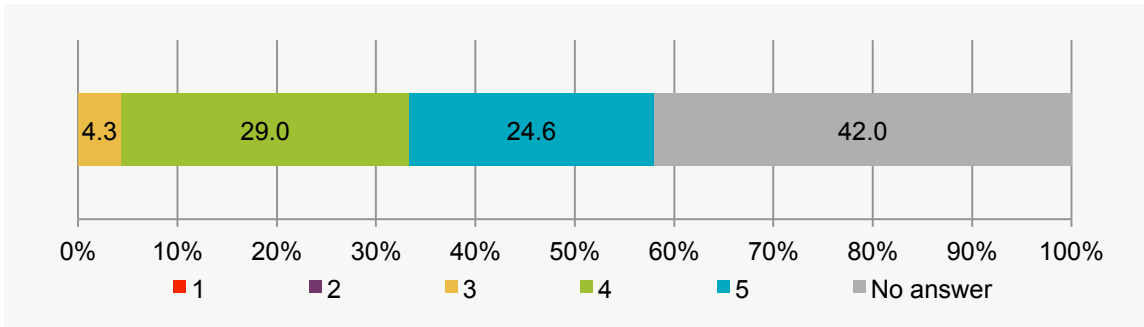


**CHART 7.22** Answers 1 = Complicated and useless; 5 = Well-structured and helpful

Average: 4.25  
 Median: 4  
 Percentage of 4 and 5: 85.3%



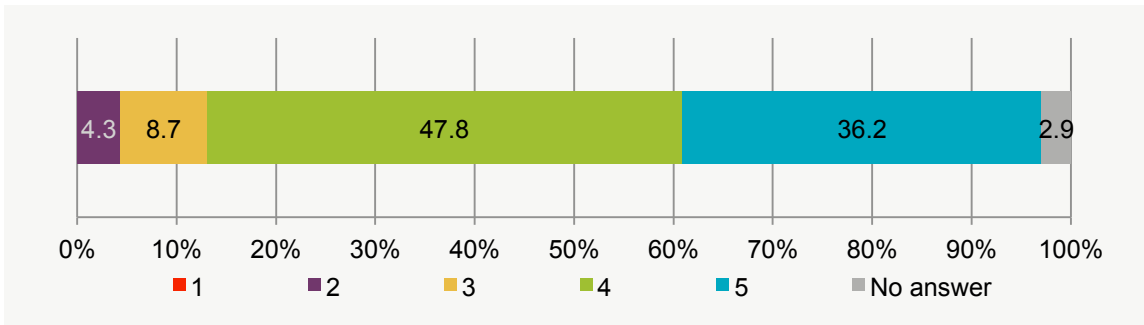
**How would you rate the timeliness of receiving the invitation letter for visa support provided by the IBO supporting team before IBO 2013? If you did not require visa support, please proceed to the next question.**



**CHART 7.23** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 4.35  
 Median: 4  
 Percentage of 4 and 5: 92.5%

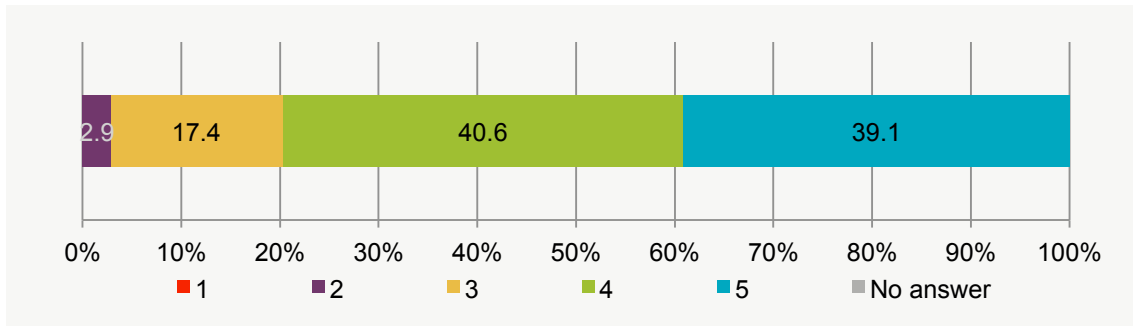
**How would you rate the registration and check-in processes at IBO 2013 in Bern?**



**CHART 7.24** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 4.19  
 Median: 4  
 Percentage of 4 and 5: 86.6%

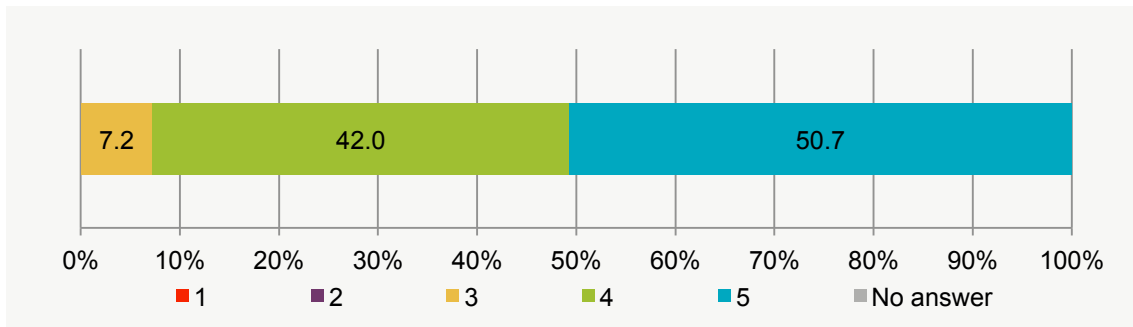
### How would you rate the accommodation at IBO 2013?



**CHART 7.25** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 4.16  
 Median: 4  
 Percentage of 4 and 5: 79.7%

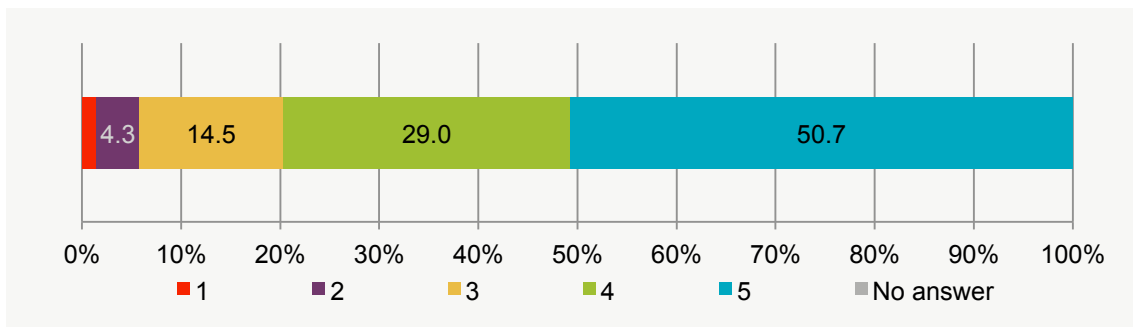
### How would you rate the transportation at IBO 2013? (Please consider especially the wide use of public transportation.\*)



**CHART 7.26** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

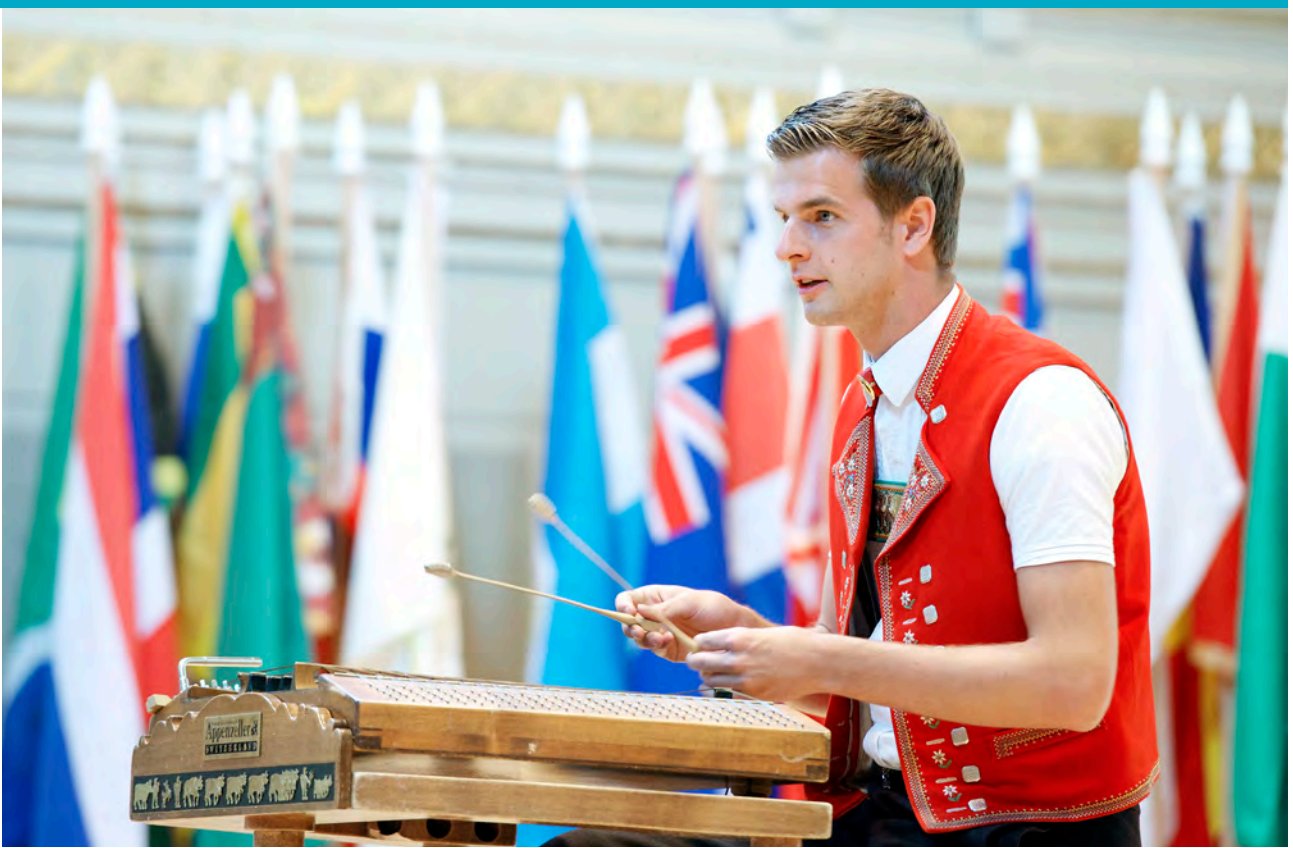
Average: 4.43  
 Median: 5  
 Percentage of 4 and 5: 92.8%

### How would you rate the food that was served during IBO 2013? Please consider food, as well as dining area, meal arrangement and logistics, etc.



**CHART 7.27** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

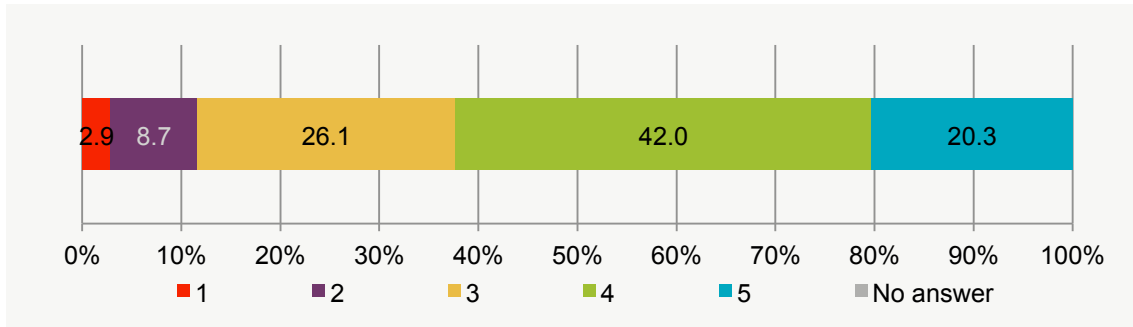
Average: 4.23  
 Median: 5  
 Percentage of 4 and 5: 79.7%



**TOP** Cultural performance at the Closing Ceremony, Nicolas Senn with the hammered dulcimer.

**BOTTOM** Medal Ceremony - always a highly emotional and colorful moment.

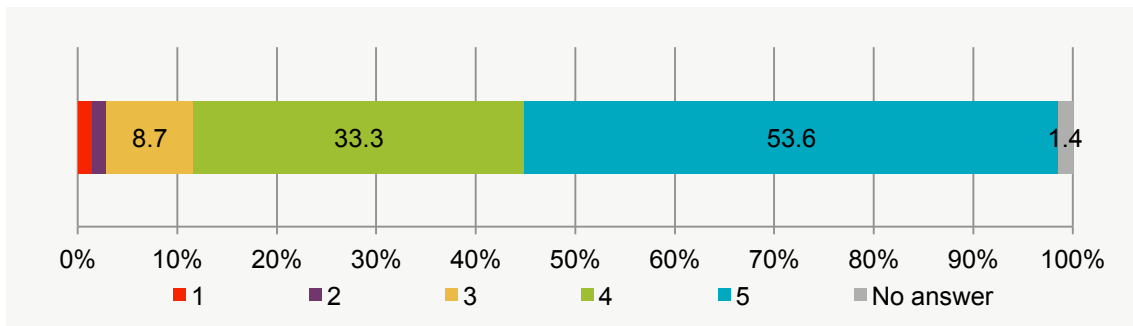
**How would you rate the Opening Ceremony at IBO 2013?  
Please give feedback based on logistics and organization rather than content.**



**CHART 7.30** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 3.68  
 Median: 4  
 Percentage of 4 and 5: 62.3%

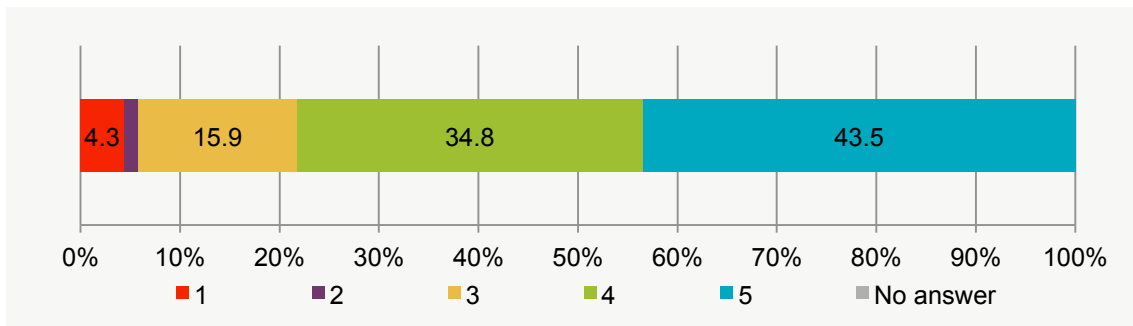
**How interesting did you find the excursions?\***



**CHART 7.28** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 4.38  
 Median: 5  
 Percentage of 4 and 5: 88.2%

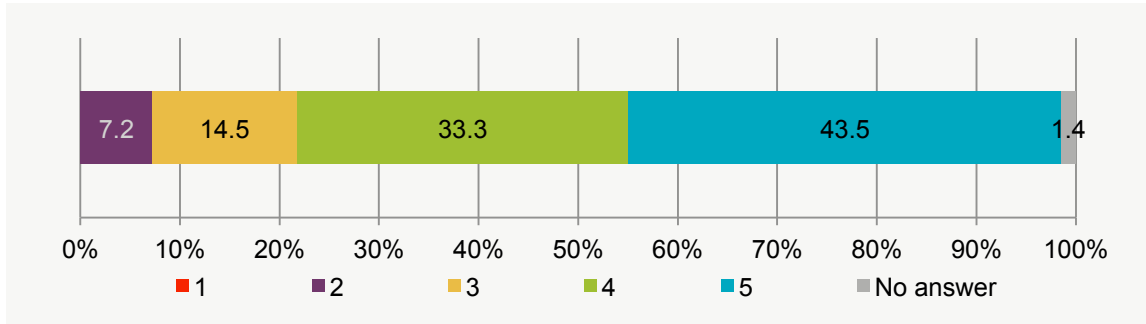
**How would you rate the time given for the jury session?\***



**CHART 7.29** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 4.12  
 Median: 4  
 Percentage of 4 and 5: 78.3%

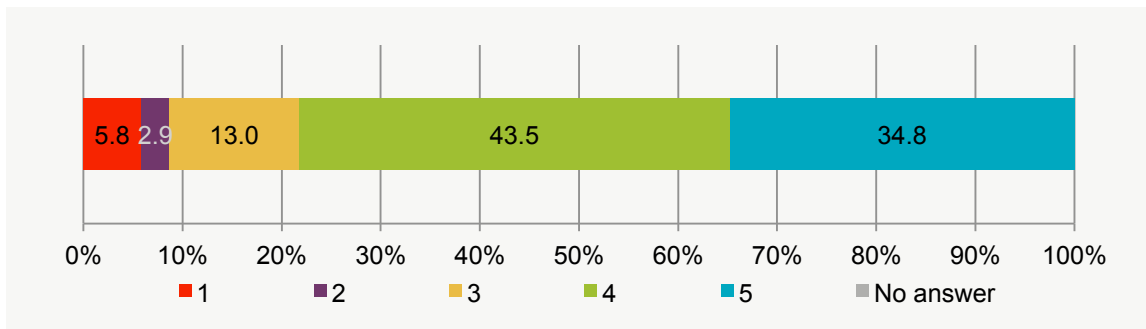
### How would you rate the overall organization of the jury session?\*



**CHART 7.31** Answers 1 = Not satisfactory; 5 = Exceeded my expectations

Average: 4.15  
 Median: 4  
 Percentage of 4 and 5: 77.9%

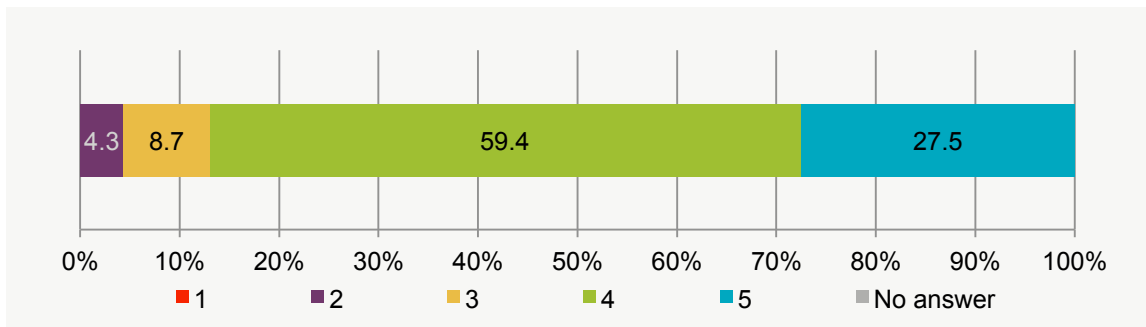
### How reasonable did you find the use of tablets for the theoretical exams?\*



**CHART 7.32** Answers 1 = Not reasonable at all; 5 = Very reasonable

Average: 3.99  
 Median: 4  
 Percentage of 4 and 5: 78.3%

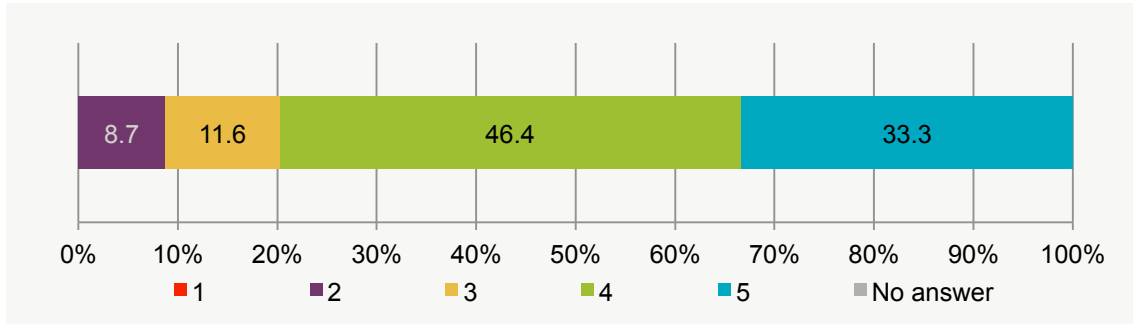
### How would you rate the quality of the practical exams?\*



**CHART 7.33** Answers 1 = Not appropriate; 5 = Perfectly executed

Average: 4.10  
 Median: 4  
 Percentage of 4 and 5: 87.0%

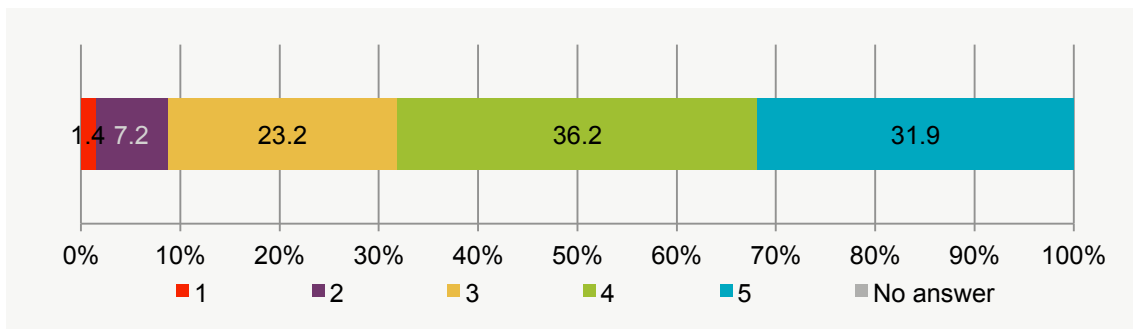
### How would you rate the quality of the theoretical exams?\*



**CHART 7.34** Answers 1 = Not appropriate; 5 = Perfectly executed

Average: 4.04  
 Median: 4  
 Percentage of 4 and 5: 79.7%

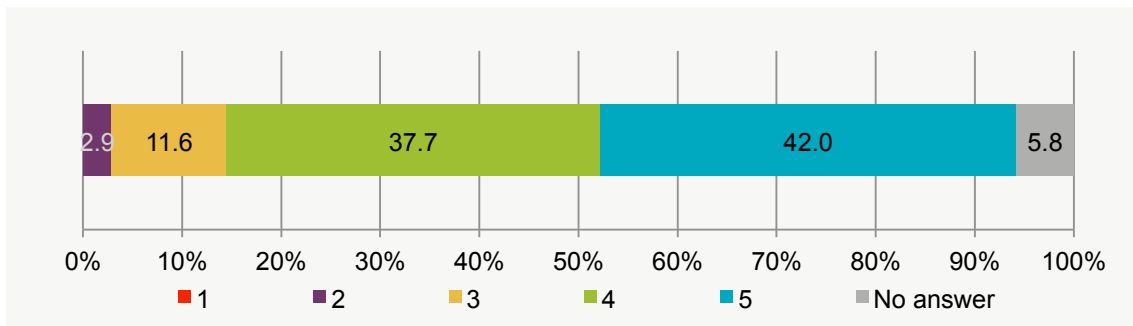
### How interesting did you find the IBO Newsletter mIBO?\*



**CHART 7.35** Answers 1 = Not interesting; 5 = Very interesting

Average: 3.90  
 Median: 4  
 Percentage of 4 and 5: 68.1%

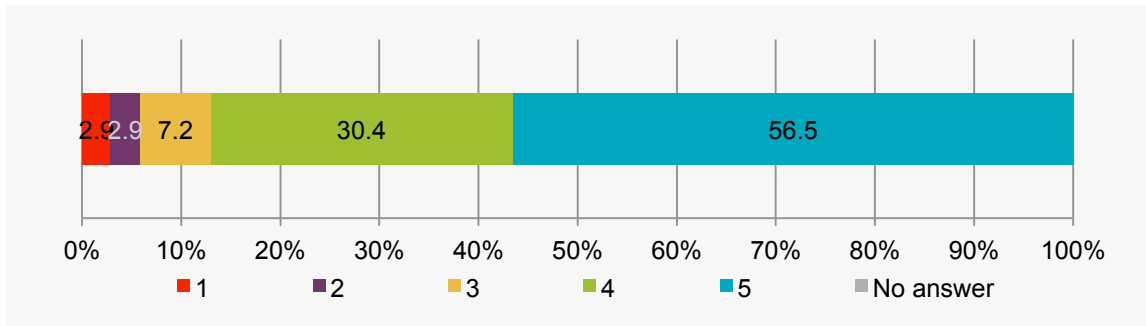
### How did you like the daily video blog?\*



**CHART 7.36** Answers 1 = Not interesting; 5 = Very interesting

Average: 4.26  
 Median: 4  
 Percentage of 4 and 5: 84.6%

### How would you rate the yearbook?\*



**CHART 7.37** Answers 1 = Useless; 5 = Very good idea

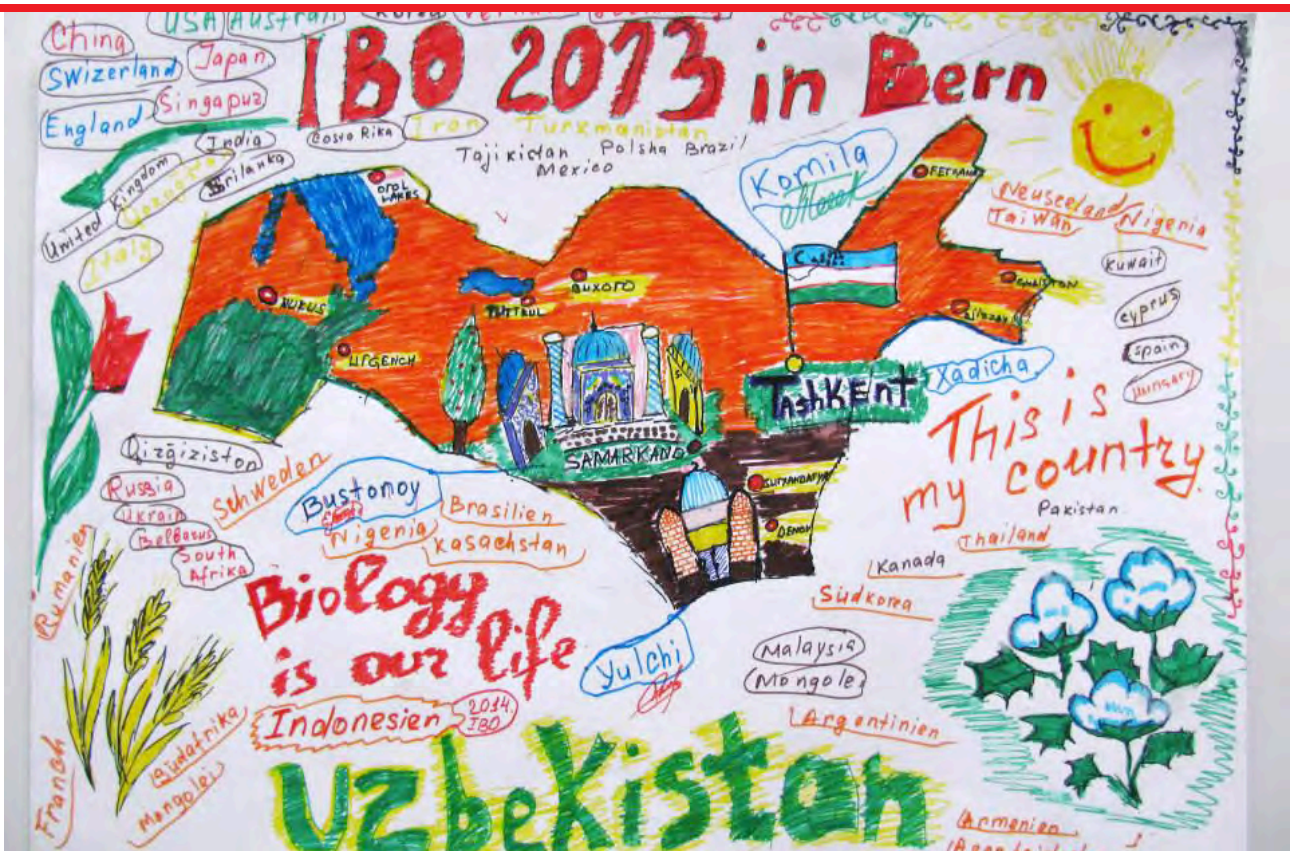
Average: 4.35  
Median: 5  
Percentage of 4 and 5: 87.0%



**TOP** Token of appreciation for the organizers, Denis Kappei (Steering Committee (SC)), Thomas Soukup (IBO Coordinating Center), Shirley Lim (SC), Mathias Wenger (Chairman IBO 2013), Daniel Wegmann (Project Manager IBO 2013), Irène Steinegger-Meier (Project Manager IBO 2013), Marco Gerber (Project Coordinator IBO 2013, Head of Secretariat), Mary Oliver (SC).

**BOTTOM** Gala dinner: a last picture before the IBO 2013 is a thing of the past.





"Biology around the World: Meet our Guests" - many creative delegations were participating in the IBO 2013.

---

# 8. Appendix

All appendices (documents, pictures, video and more) listed below can be found on the DVD provided along with the final report.

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## 8.1 Media

### 8.1.1 Selection of Pictures

Find an extensive collection of pictures made during the IBO 2013 in our online photo gallery:

➔ [www.ibo2013.org/Media/Publications/photos](http://www.ibo2013.org/Media/Publications/photos)

### 8.1.2 Media Coverage

A selection of articles published in newspapers and websites can be found here:

➔ [www.ibo2013.org/webcontent/downloads/media\\_coverage\\_ibo2013.pdf](http://www.ibo2013.org/webcontent/downloads/media_coverage_ibo2013.pdf)

### 8.1.3 Daily Video Blog

All daily video blogs published during the IBO 2013 can be found here:

➔ [www.ibo2013.org/Media/Publications/films/dailyblog/](http://www.ibo2013.org/Media/Publications/films/dailyblog/)

### 8.1.4 Video IBO 2013

The video summarizing all daily blogs and the IBO 2013 as a whole is available here:

➔ [www.ibo2013.org/Media/Publications/films/ibo2013](http://www.ibo2013.org/Media/Publications/films/ibo2013)

### 8.1.5 Bio Video Competition – The Winner

The winning video of the Bio Video Competition of the Swiss and Liechtenstein delegations can be accessed here:

➔ [www.ibo2013.org/Media/Publications/films/videocompetition/](http://www.ibo2013.org/Media/Publications/films/videocompetition/)

### 8.1.6 mIBO – The IBO 2013 Newsletter

All 8 daily mIBO newsletters are available as PDFs on our website:

➔ [www.ibo2013.org/Media/Publications/mIBO%20-%20Newsletter/](http://www.ibo2013.org/Media/Publications/mIBO%20-%20Newsletter/)

### 8.1.7 IBO King's Cup Pictures

All ten pictures of the IBO King's Cup published on a monthly basis on Facebook can be down-loaded here:

➔ [www.ibo2013.org/webcontent/downloads/IBO\\_Kings\\_Cup.zip](http://www.ibo2013.org/webcontent/downloads/IBO_Kings_Cup.zip)

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## 8.2 Exams

### 8.2.1 Theoretical Exams

According to the IBO rules, all exams are made available to the public two years after each IBO. All exams currently available can be found here:

➔ [www.ibo-info.org/ibo-results-and-awards](http://www.ibo-info.org/ibo-results-and-awards)

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## 8.2.2 Practical Exams

According to the IBO rules, all exams are made available to the public two years after each IBO. All exams currently available can be found here:

➔ [www.ibo-info.org/ibo-results-and-awards](http://www.ibo-info.org/ibo-results-and-awards)

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## 8.2.3 Final Ranking

The final ranking and all results are available here:

➔ [www.ibo2013.org/ibo2013/Results/](http://www.ibo2013.org/ibo2013/Results/)

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## 8.2.4 Translated Languages

An overview of all languages used by all delegations for the translation of the exams is available as an Excel file here:

➔ [www.ibo2013.org/webcontent/downloads/translated\\_languages.xlsx](http://www.ibo2013.org/webcontent/downloads/translated_languages.xlsx)

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# 8.3 Miscellaneous

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## 8.3.1 Participation Statistics of Former IBOs

Numbers such as the number of participating delegations, delegation sizes and further information on the IBOs 2007 to 2013 are available in an Excel format here:

➔ [www.ibo2013.org/webcontent/downloads/participation\\_statistics.xlsx](http://www.ibo2013.org/webcontent/downloads/participation_statistics.xlsx)

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## 8.3.2 Timing of Ceremonies

The timing of both the opening and the closing ceremony are available as PDFs here:

Opening Ceremony: ➔ [www.ibo2013.org/webcontent/downloads/opening\\_ceremony.pdf](http://www.ibo2013.org/webcontent/downloads/opening_ceremony.pdf)

Closing Ceremony: ➔ [www.ibo2013.org/webcontent/downloads/closing\\_ceremony.pdf](http://www.ibo2013.org/webcontent/downloads/closing_ceremony.pdf)

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## 8.3.3 Seating Arrangements in Jury Room

A PDF of the seating arrangement in the Jury room can be found here:

➔ [www.ibo2013.org/webcontent/downloads/seating\\_arrangements\\_in\\_jury\\_room.pdf](http://www.ibo2013.org/webcontent/downloads/seating_arrangements_in_jury_room.pdf)

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## 8.3.4 Medals

A picture of the medals distributed to the students can be seen here:

➔ [www.ibo2013.org/webcontent/downloads/medals\\_ibo2013.JPG](http://www.ibo2013.org/webcontent/downloads/medals_ibo2013.JPG)

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## 8.3.5 Form Electronic Devices

The form each student had to fill in with regards to the use of electronic devices can be found here:

➔ [www.ibo2013.org/webcontent/downloads/electronic\\_devices\\_form.pdf](http://www.ibo2013.org/webcontent/downloads/electronic_devices_form.pdf)



Medals IBO 2013.



Students exploring the alpine flora on their excursion to Mount Niederhorn.

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# Inprint

## **Editors**

Marco Gerber

Irène Steinegger-Meier

Daniel Wegmann

## **Proof Reading**

Marco Gerber

Irène Steinegger-Meier

Marlis Zbinden

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Bendicht Erb | ojo3.com

## **Pictures**

Manu Friederich

Hoang Pham

Myriam Planzer

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