Impact Survey

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e2WAYS

Communicating Life Science Research

2WAYS

Impact Survey

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Abstract

Science events are no longer isolated hands-on workshops created by a couple of 'science freaks', but have become a part of a larger movement promoting public understanding of science. They are influenced by not only the scientific community, but also by the other groups of society and vice versa. They also have a certain effect for the future career choices of young people and students.

- The *over-all satisfactory level* of the 2WAYS events was good. The survey showed some differences between the feed-back of the visitors. Does it depend on different type of events, different type of cultures, or different type of visitor expectations?
- *Children* (under 15 years old) and *middle-aged adults* (aged 40-54 years) gave the most positive feedback of the 2WAYS events.
- The *overall effect* of 2WAYS –event cannot be extremely strong, because the visit is lasting typically only 2-3 hours. However, *clear situation motivation* effects were found.
- The challenge for the further research is, if the visitors already had a realistic vision about the role of science, and the 2WAYS –type of event was *not changing it but confirming it.*
- People visiting the 2WAYS-happenings in different countries in Europe were satisfied with their experience in terms of *recommending the happening* or similar effort for their friends, families, and other people.
- *The willingness to recommend* 2WAYS type of event was highest in Finland and Spain.
- *Do people need intellectual activities* during their leisure time? Very active people had slightly more positive feedback than others from 2WAYS-event.
- It seems that the traditional institutes have a real challenge in offering *meaningful content and context* for teenagers and young adults, who typically attend several cultural, film, sports and music events during their leisure time.
- The 2WAYS-students felt and reported more *meaningful and motivating learning* effects related to the Science Parliament event than compared to ordinary classroom environment.
- One of the main goals of the Science Parliament events was *to encourage discussion and dialog* between the youngsters and the experts and decision makers.
- The students felt the Science Parliament environment *encouraging more to asking* questions and discussion. The result was clear and statistically significant.
- As key components in the survey were found *interactive* and *team work nature* of the Science Parliament
- The students in European schools do value their studies at school: *the content and the context of the education* has to be essential for them personally.
- *Meaningful learning has two components*. First, the content should be meaningful for the learner. Second, the learning process should be arranged pedagogically in a meaningful way (according to the age and the former knowledge and skills of the learner and by the logical structure of the topic to be taught.) All the great innovations in education have been based on putting these two principles into practice.
- The strongest effect of the 2WAYS event was the bigger *interest in science* in the post-test after the visit
- The vision about the role of the scientists as human persons did change a lot. After their visit to the events the students did agree in a greater level with the statement *"the researchers are interesting and fascinating persons"*.
- However, the students *did not change their views* or opinions related to their *future plans*, in their *university studies* or *work careers*.
- The students did not automatically consider the learning process in the 2WAYS event as an easy one, but *realised the complex nature of the topic*.
- Surprisingly, the students saw the 2WAYS Science parliament events *not less formal* than the classroom education. The reason for this might be the arrangements of the mass events demanding control in the auditorium and in seminar environments. The adults try to keep their authority also in the Science Parliament type of informal learning occasions.
- Science, research and technology is – naturally – *for both genders*. That was proven in the lively 2WAYS events around the Europe – attended by majority (57%) of female visitors.
- The 2WAYS-events were oriented and attended by *visitors with upper educational background*. The majority (59%) of visitors had academic background, and the second biggest group (24%) consisted of people having higher vocational education level. Only a very small amount of visitors had the lower vocational education, or the basic education.
- Children and young people visited the happenings mainly *during their school days* as hands-on, open learning experience & environment
- Science matters. Also in the *everyday life level.*
- There was *not remarkable differences between the age groups* how they recognises science having an effect on their every-day life.
- *2WAYS visitors in Switzerland* think that science has the strongest impact on their daily life.
- Young people (16-24 y) do not think science has a clear effect on their everyday life. Is this due to their *critical attitude during the teen years*; or has the science education been unsuccessful during that time in the school?
- People with the upper educational background tend to see that science has clearly a bigger effect on their everyday life than other groups. – *Academic people* often work in science related occupations.
- *Real Event or Virtual Experience?* As a summary, there were clear differences between the people visiting the real 2WAYS events compared to those who only visited the web-site.
- www.twoways.eu: *"Web-visitors"* had less public science activities during the previous 12 months; and they also did not consider the link between science and everyday life as evident as the *"real-visitors"*.
- The aim of science education methods is not solely to produce more scientists and technologists; it is also to produce a new generation of *citizens who are scientifically and technologically literate.*

Data, dates, countries, samples & facts

This report describes selected results of a survey administrated in seventeen European countries (France, Italy, Spain, Finland, Switzerland, United Kingdom, Germany, Austria, Sweden, Latvia, Israel, Estonia, Denmark, Portugal, Bulgaria, Ireland, and Poland).

The data was collected in connection with the 2WAYS Science Events arranged in these countries during summer 2009 to autumn 2010.

The total amount of the interviews gives an opportunity to make certain statistical comparisons.

2WAYS Events	1404 questionnaires
Young Europeans Science Parliaments	797 pre- and 728 post-questionnaires
Web-survey	4672 web-answers

However, this data is not based on a clear random sample but more on a sample selection.

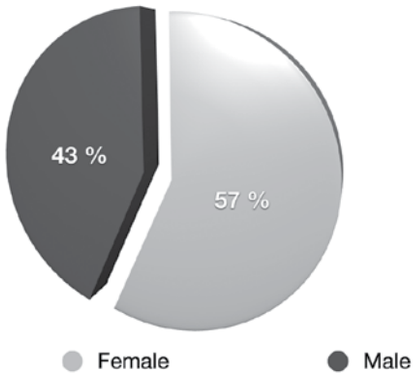
In addition, the people attending the 2WAYS-type events vary a lot, as do the events in their size, place and nature! Due to this the results are reported according to total data, and in some cases to show the most typical phenomena or characters of different countries and events.

These preliminary results will be complemented, and the end results will also be compared to the Eurobarometer science attitude results.

Part I: 2WAYS events

Who did attend the 2WAYS-events?

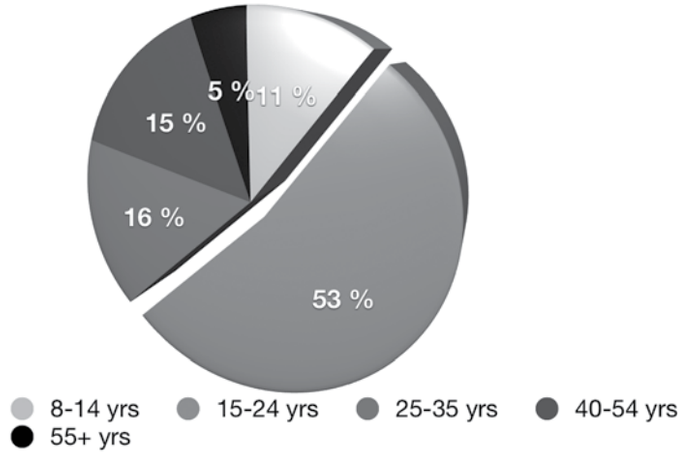
Female visitors are the clear majority in most of cultural activities like museums and art exhibitions are the female visitors. In science centres and technology museums the distribution is more equal. 2WAYS-events have succeeded to create a concept, which fits for both genders (as shown in the next figure):



Female visitors formed a majority (57 %). This indicates the success in breaking the traditional, slightly male-orientated science happening attending tendency. Among the adult visitors (aged over 25 yrs) the proposition of female visitors was even slightly bigger (60%).

Then you stay, forever young?

As the visitor behaviour literacy and other survey reports show, the amounts of teen-agers and young people are typically under-represented as museums visitors.

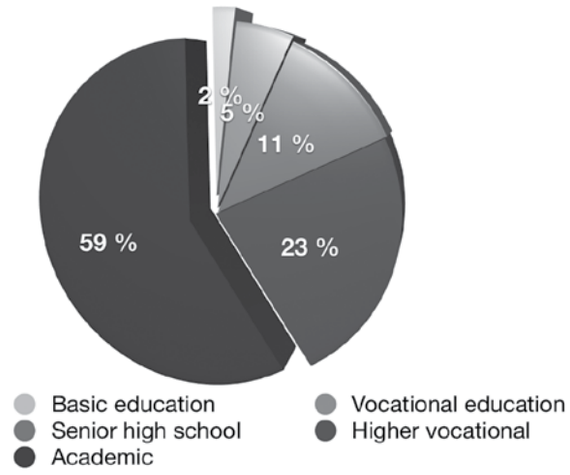


However, the majority (53%) of the people attending and answering the questionnaires in 2WAYS-events were youngsters (as shown in the figure above).

Many of the young visitors came to 2WAYS events as part of their school programme.

Educational level

This question is reported only for the adult visitors more than 25 years old, because children and young people still are at school or other institutes gaining their education.



The 2WAYS-events were clearly oriented and attended by visitors with upper educational background. The majority (59%) of visitors had academic background, and the second biggest group (24%) consisted of people having higher vocational education level. Only a very small amount of visitors had the lower vocational education, or the basic education.

In this sense the 2WAYS-events did not succeed in gaining new audiences compared to the permanent science centres, technology exhibitions or museums.

Science impact on daily life: gender aspects related to research and technology

According to the answers of the visitors, they see that the over-all effect of science rather strong on their every-day lives: the average level is 4,02 (with the scale 1= very weak… …5= very strong).

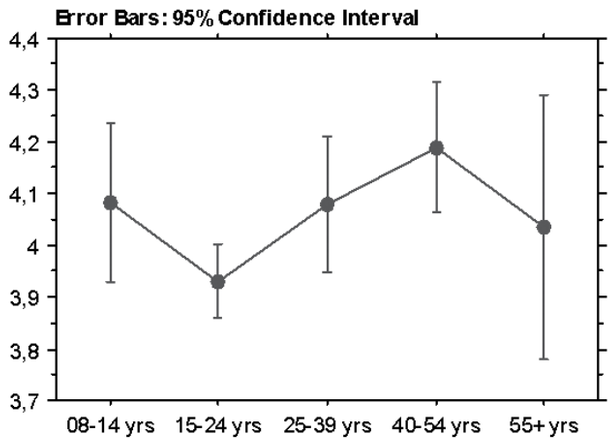
The male visitors tend to see and feel the relation of science and every-day life stronger than the female visitors.

The difference was big enough to be statistically significant (p = .034).

There were also differences between countries, age groups and educational level to be further analysed.

Science impact on daily life: age

The variance related to attitudes related to science and research tends to vary a lot related to the background of the people: age is one of the main components in this sense.



Young people (16-24 y) do not think science has an effect on their everyday life. Is this due to their critical attitude during the teen years; or has the science education been unsuccessful during that time in the school?

The adults and middle-aged people do recognise science having an effect on their every-day life in many occasions.

The oldest age group (more than 55 y) have the biggest variance.

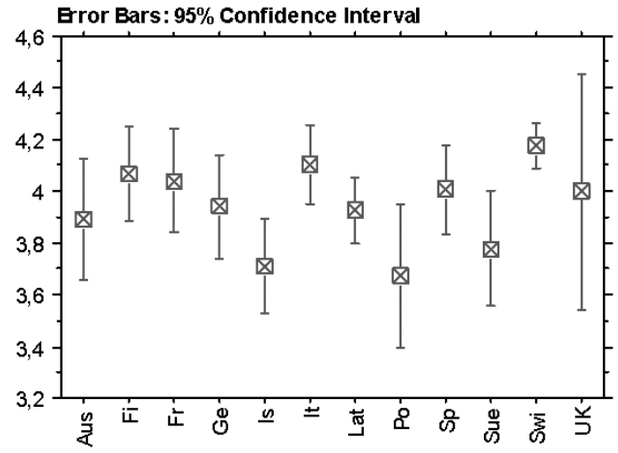
Children (aged less than 15 y) feel science a lot in their everyday lives.

However, the difference was statistically significant only between the youngsters (15-24 y) and the middle-aged adults.

Young people do not think science has an effect on their everyday life. Is this due to their critical attitude during the teen years; or has the science education been unsuccessful during that time in the school?

Science impact on daily life: country

The differences between the opinions related to the impact of the science and technology on the citizens' every-day life were somewhat similar in the European countries arranging the 2WAYS events, as shown in the next Table:

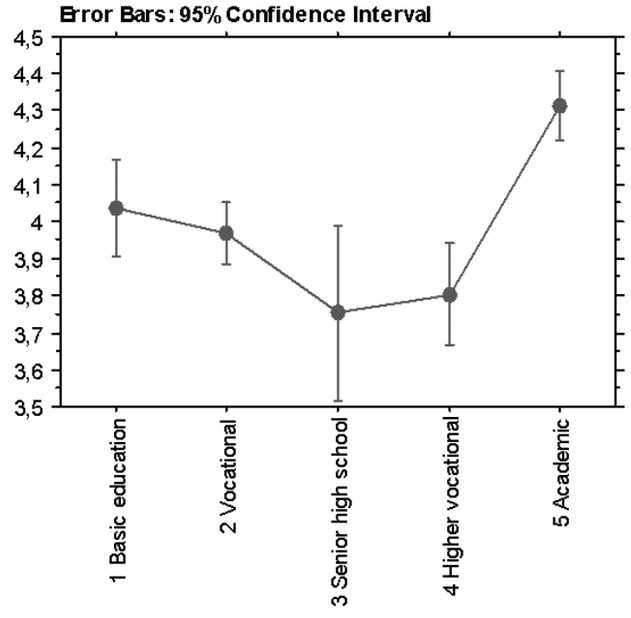


Compared to the other countries, the visitors in Switzerland think that science has the strongest effect on their daily life.

The difference is clear and statistically significant compared to results in many other countries as shown in the figure above. – However, the reason for the differences is caused more by the different type of groups interviewed, although the audiences of 2WAYS events should be rather homogenous in different countries.

Science impact on daily life: educational level

According to the literature, the educational level and background of the citizens seem to be one of the main factors in people's attitudes towards science, research and technology. This tendency was one of the clearest results found also in the 2WAYS results as shown below:



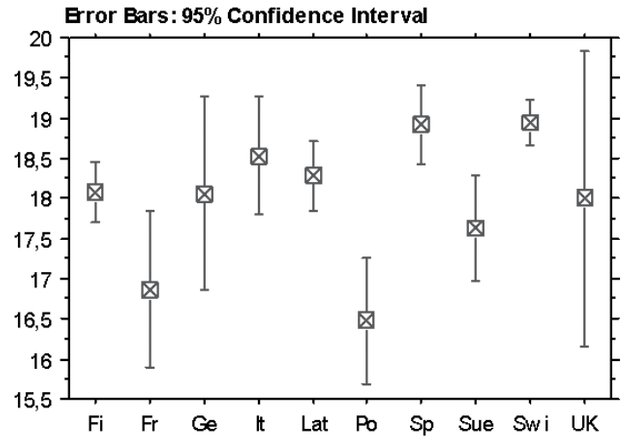
People having the highest educational level tend to see that science has clearly a bigger effect on their every-day life than other groups.

Surprisingly, the senior high school level did not see clear links between science and their every-day experiences. This is really an important dilemma, because this group consists mostly from young people between 15 to 24 years who are still in the senior high school level or just starting their further higher vocational or academic studies.

2WAYS visitor feedback

(Interesting + understandable + learning + every-day life + general science attitude)

The feedback given by the visitors varied a lot between the countries, as shown in the figure below. Does it depend on different type of events, different type of cultures, or different type of visitor expectations?

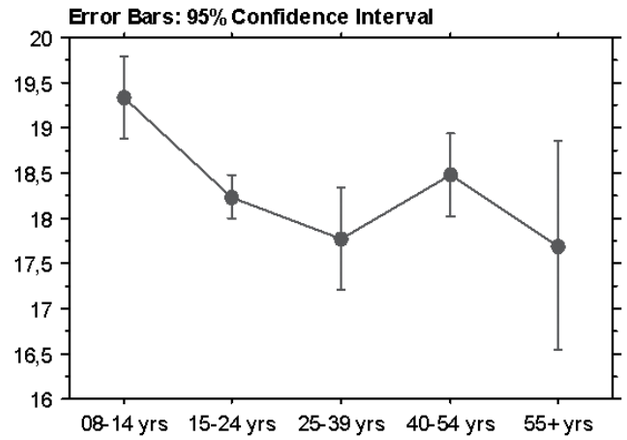


The visitors in Switzerland gave clearly the most positive feedback. [This group was attending clearly less other public science activities as their hobby as shown later in this survey.]

According to their answers, the visitors in France and Poland were not totally satisfied with the 2WAYS event.

2WAYS visitor feedback vs. age

The over-all satisfactory level was good. The survey showed clear differences between the feed-back of the visitors in different age groups as shown in the next table:

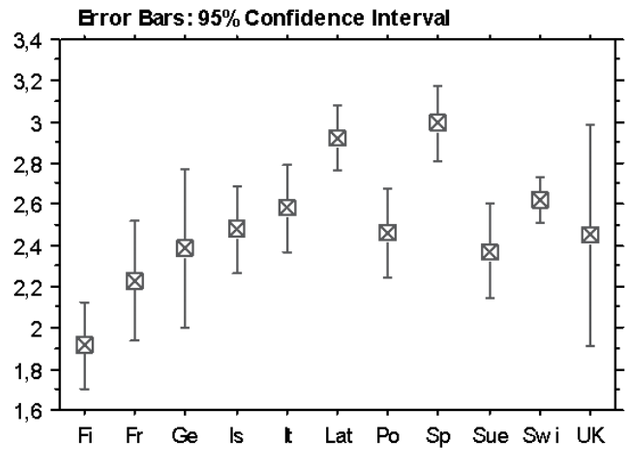


Children (under 15 years old) gave the most positive feedback of the 2WAYS events.

The oldest age group (aged over 55 years) and adults (25 – 39 years) gave more critical and less satisfied feedback related to 2WAYS event. The middle-aged adults (aged 40-54 years) gave more positive feedback.

2WAYS event impact on general attitude towards science: countries

The visitors were asked if the 2WAYS-event had an effect on their general attitude towards science.



The overall effect of 2WAYS –event cannot be extremely strong, because the visit is lasting typically only 2-3 hours.

The effect in Switzerland and Spain was biggest and lowest in Finland.

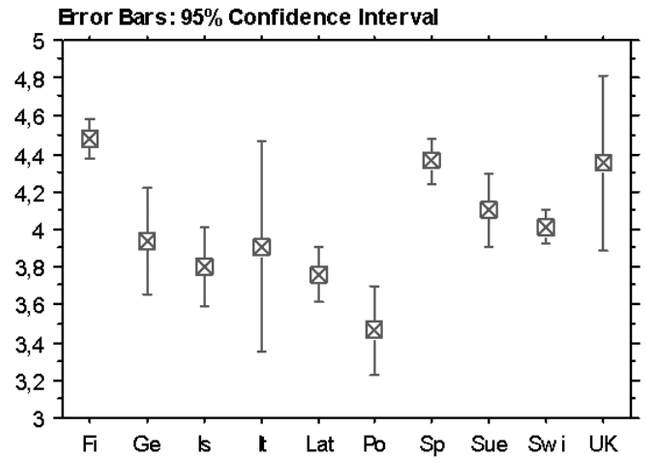
The difference between Finland and other countries was clear and

statistically significant (p: <.05).

The challenge for the further research is, if the visitors already had a realistic vision about the role of science, and the 2WAYS –type of event was *not changing it but confirming* it.

2WAYS-visitors recommending science happening for other people: countries

People visiting the 2WAYS-happenings in different countries in Europe were satisfied with their experience in terms of recommending the happening or similar effort for their friends, families, and other people. The value of the feedback was 4,05 (in Likert-scale 1=poor…. 5=excellent), which can be qualified as a good result. - As comparison, in some science centres the long term recommending value raises up to 4,5, which can be considered as excellent value.

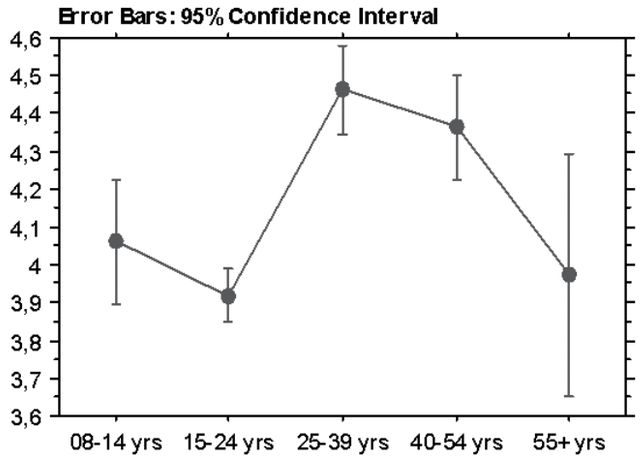


The willingness to recommend 2WAYS type of event was highest in Finland and Spain.

People visiting the 2WAYS-happenings in different countries in Europe were satisfied with their experience in terms of recommending the happening or similar effort for their friends, families, and other people.

2WAYS-visitors recommending science happening for other people: age

Young people (15-24 years) were the vast majority (43%) of the audience. However, they were not full heartedly recommending the happening for the other people or their peer groups as can be seen from the figure below:

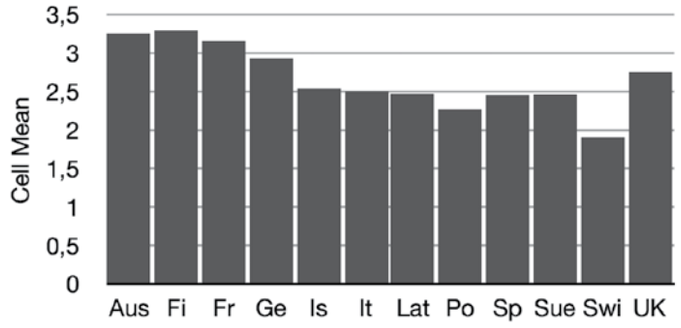


Also older people (aged more than 55 years old) gave the lower level recommendation feedback. However, the amount of these people in the sample was small, only 4% of the audience. Further analysis for this is needed.

Middle-aged adult visitors did not hesitate to recommend the 2WAYS-events for the other people!

Do people need intellectual activities during their leisure time?

People visiting the 2WAYS-happenings in eleven countries were asked what other leisure time activities related to *public science* (like zoo, science centre, museum, science exhibition, public library) they had visited during the last 12 months.



The most active visitors were found from Finland, Austria, France, and Germany.

People arriving to 2WAYS event in Switzerland had attended only two other public science related activities during the previous year.

The most popular activity was public library: 67,4% of the people interviewed had visited one during the last 12 months.

The proportion of passive people not visiting any other science related activity during the previous year was 7,1 %. – It must be noticed that this group contained very few young people (15-24 years).

Children and young people were definitively the most active users of the public libraries. However, in all the other public science activities young people had the smallest proportion.

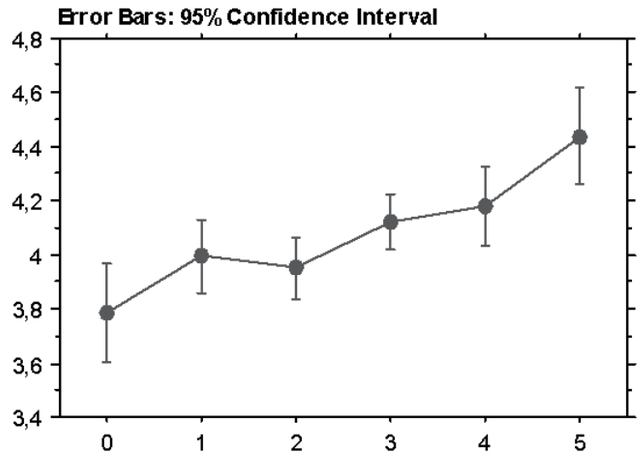
It seems that the traditional institutes have a real challenge in offering *meaningful content and context* for teenagers and young adults, who typically attend several cultural, film, sports and music events during their leisure time.

The most popular activity was public library: 67,4% of the people interviewed had visited one during the last 12 months.

2WAYS-feedback vs. overall Leisure time Activity

Museums, cultural institutes, and also several leisure time activities have recently been criticised for having the upper middle class people as their target audience and for not having been capable to gain mass audiences of lower educational or small income level.

In principle, 2WAYS-events took place in public places with easy access for mass audiences. Did the newcomers enjoy the happenings?



Passive people (0-1; no or only one other science related leisure time activity) gave lower level feedback related to 2WAYS-event. However, the difference was not statistically significant (< .05) compared to the other groups.

Very active people (5; attending five or more leisure time activities per year) had slightly more positive feedback than others from 2WAYS-event.

Part II: Science Parliaments

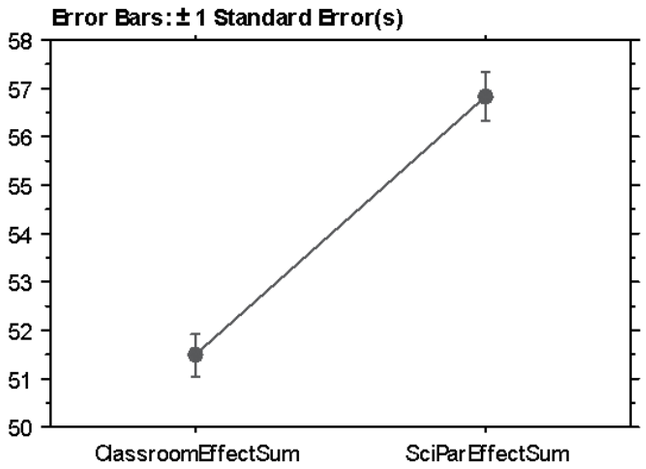
Informal learning

'The aim of science education methods is not solely to produce more scientists and technologists; it is also to produce a new generation of citizens who are scientifically and technologically literate.'- P. Coombs

Bridging the gap between formal education and informal learning is clearly one of the main challanges of the contemporary and future science education.

Informal education has often been regarded as the opposite to formal education. Since the 1990s, however, informal education has become a widely accepted and integrated part of school systems.

The motivation and opinions about the learning value of the students attending the *2WAYS – Science Parliament* event was evaluated by the standard SD - Semantic Differentiate questionnaire, which compares the science learning experience in classroom and out-of-school context (as shown in the figure below):



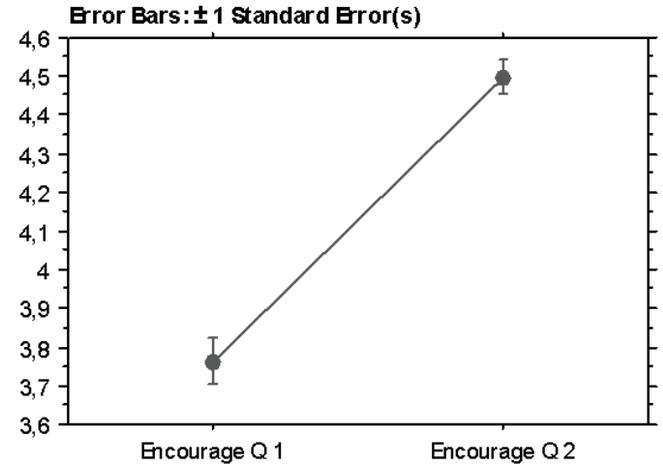
As an overall summary effect, the students felt and reported more meaningful and motivating learning effects related to the Science Parliament event than compared to ordinary classroom environment.

There are no stupid questions!

One of the main goals of the Science Parliament events was *to encourage discussion and dialog* between the youngsters and the experts and decision makers.

The starting point for this type of "two-way communication" is of course asking questions. Often the most simple and stupid questions are the best and sharp ones. However, to be afraid of losing your face while being totally wrong or innocent in front of many other peer group people – or highly ranked authorities and experts – may hinder especially the young people to express their opinions.

2WAYS events turned out to succeed in creating an open-minded atmosphere in its' Science Parliament events (as shown in the next figure):



Compared to traditional classroom conditions, the students felt the Science Parliament environment encouraging more to asking questions and discussion. The difference was clear and statistically significant.

Hypothesized Mean = 0

	Mean	DF	t-Value	P-Value
Interactive 3.10	3,280	285	49,935	<,0001
Interactive 3.10.2	4,066	287	61,632	<,0001

As can be seen from the tables (above and below), two other key components were *interactive* and *team work nature* of the Science Parliament event compared to more traditional classroom learning environment.

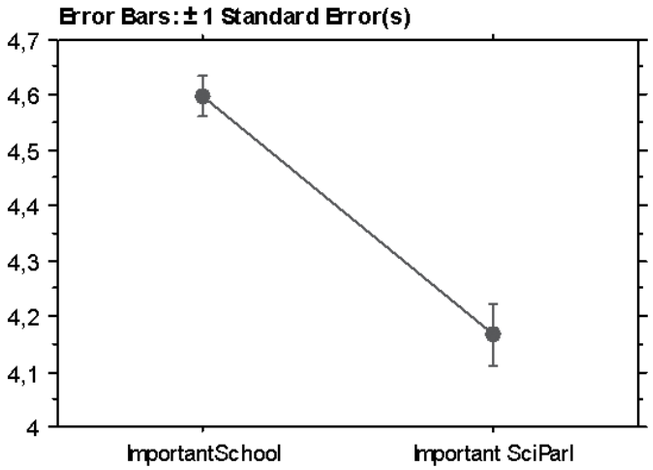
Hypothesized Mean = 0

	Mean	DF	t-Value	P-Value
Encourage to teamw ork 3.13	3,416	285	53,407	<,0001
Encourage to teamw ork 3.13.2	4,280	288	74,022	<,0001

Why or how to learn?

Meaningful learning has two components. First, the content should be meaningful for the learner. Second, the learning process should be arranged pedagogically in a meaningful way (according to the age and the former knowledge and skills of the learner and by the logical structure of the topic to be taught.) All the great innovations in education have been based on putting these two principles into practice.

One of the factors that the students were clearly ranking higher in traditional school teaching was the fact how important they feel the cognitive learning effect is for them (see figure below):



Although the value given for Science Parliament in this factor was a high score (scale: 1 = not at all;..5 = very important), however, the score of the school science education was still much more important. The difference was statitically significant.

The other aspect where the students valued the school effect slightly bigger was how *essential the content and the context of the education* is for them personally.

The students did not automatically consider the learning process in the 2WAYS event as an easy one, but realised the complex nature of the topic.

Surprisingly, the students saw the 2WAYS Science parliament events *not less formal* than the classroom education. The reason for this might be the arrangements of the mass events demanding control in the auditorium and in seminar environments.

To become or not to become... ...a researcher?

Science fairs, events, museums, and science centres state their main goals with slightly different wordings (and in different languages!), but the following key ideas are European wide: the institutes promote public understanding of science, create positive attitudes towards science and technology, encourage young people, in particular, to learn science and take up careers in science and technology, and maximise the opportunities in society for scientific applications. How much evidence is there to show that these main goals are realised in the everyday functions of a science event like 2WAYS? Answering this question is not easy, although we know that everyday experience suggests that these pragmatic outcomes can be achieved.

The students attending the 2WAYS events did change their opinions and attitudes related to the *role of science in society*.

The two most strong effects were

1) the bigger *interest in science* in the post-test after the visit, and
2) the vision about the role of the scientists as human persons did change a lot. After their visit to the events the students did agree in a greater level with the statement *"the researchers are interesting and fascinating persons"*.

The changes in these attitudes were clear and statistically significant.

However, the students did not change their views or opinions related to their future plans, in their university studies or work careers.

Part III
Web survey

Real Event or Virtual Experience?

To promote public understanding of science, new forms of education are actively being sought. A huge amount of information, especially about modern phenomena, is obtained in a personal way from family, friends and peer groups. Furthermore, the roles of television, libraries, magazines and newspapers are also essential. The numbers of visitors at museums and science centres as science events have increased regularly during the last decades.

Most of these forms of events and education can be classified as informal learning, either focused on young people via informal, out-of-school education programmes or as clearly informal learning occurring totally outside any educational institutes for young people or adults.

However, meeting other people is anyway the best source for interactive communication. And getting a chance to ask real questions from the best experts happens on rarely. The people visiting the 2WAYS -events and students attending the Science Parliament –gatherings highly appreciated this opportunity.

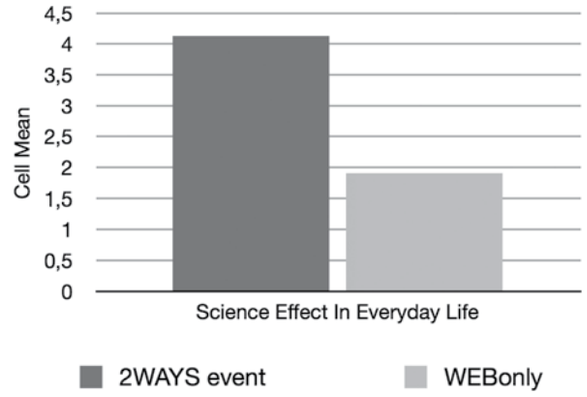
Informal education has often been regarded as the opposite of formal education. Since the 1990s, however, informal education has become a widely accepted and integrated part of school systems. Despite this development, little theoretical or empirical research has been done on informal education. Recently, informal learning has become a more accepted part of educational science, although there is still very little valid research, e.g. about such a central topic as learning via the Internet and so called social media.

2WAYS events created also their own website – www.twoways.eu – linking the European actors together. It was visited by tens of thousands of web-visitors, and very big amount (n: 4672) of these web-visitors also filled in the web-survey related to impact of science on their everyday lives. Only 4,2% of the web-answers were visiting also the real event.

As a summary, there were clear differences between the people visiting the real 2WAYS events compared to those who only visited the web-site.

What is the impact of science on your everyday life?

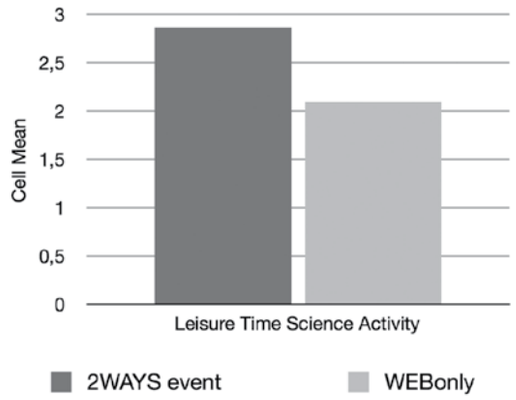
As reported earlier, the 2WAYS-events visitors gave high ranking values concerning their vision about the impact of science, technology and research related to their everyday activities. How common this opinion is among the greater audiences?



The difference between “real-visitors” and “web-visitors” is clear.

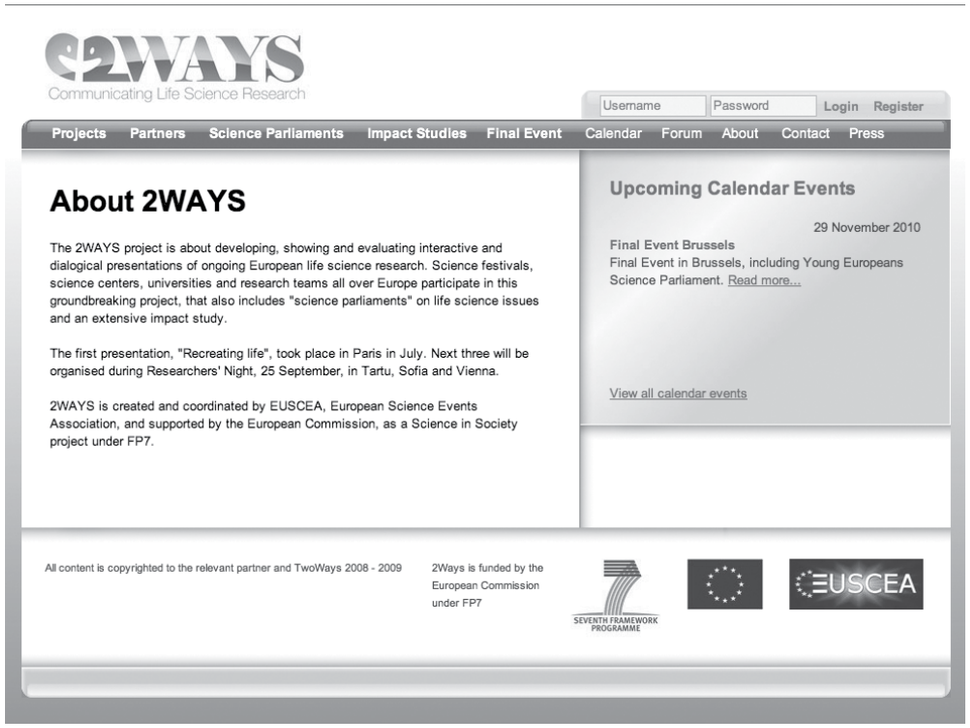
Certainly one of the main reasons for the difference lays in the background factors of the visitors. Although 2WAYS events are orientated to mass audiences and “ordinary people”, however, it tends to appeal eager “science freaks” interested as well as by-passing more passive people. The next figure tells about the differences in science activities:

The difference between “real-visitors” and “web-visitors” is clear.



The average amount of public science activities during the last twelve months was clearly bigger (2,86) among the real-visitors than the web-visitors (2,09).

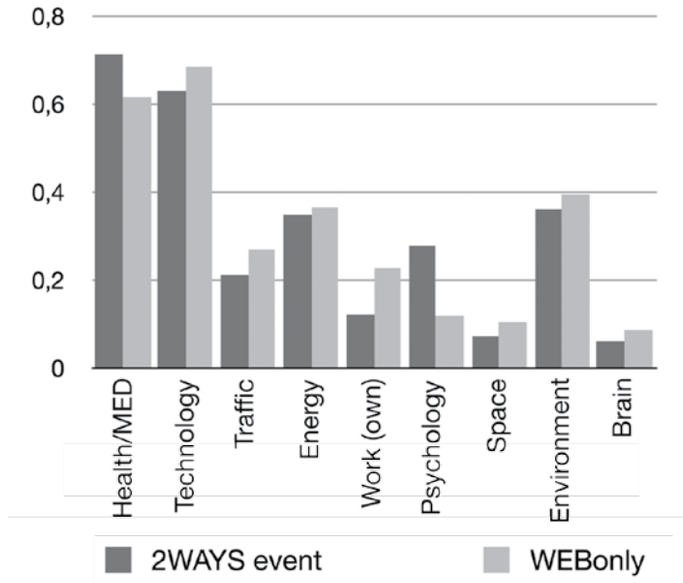
However, the most obvious reason for the 2WAYS events real-visitors' visions seeing the science and technology meanings in their everyday activities is, of course, the lively interactive public understanding of science happening they have just attended. The events gave them direct hands-on experience to scientific research and its' links to everyday life!



Under the influence of science, technology and research?

The gender difference among the web-visitors was much bigger compared to the real-event visitors. While the difference between male and female visitors attitude in "everyday science aspect" was just visible among the real-visitors ($p = .03$), in the data of web-visitors this difference was most distinctive ($p = .001$). This result might indicate the strong social impact and nature of human interaction during the 2WAYS events making the science, research and technology more present in different fields of everyday activities.

In most of the research reports like Eurobarometer the *health and medicine* is most often considered as the scientific field effecting mostly people's everyday life. This was also the case in this survey as shown in the next figure:



The web-visitors were underlining the role of technology, traffic, and energy as the central factors of science having an impact on citizens' everyday lives. They – more adults - also found more links between their own work and science. Health, medicine, and psychology were on the top of the list by the real-visitors. The official name of the project is according to the logo "Communicating *Life Sciences* Research – 2WAYS". Maybe the content of the events was more concentrated in biology, medicine, etc. and not to basic research and technology. The environmental aspects were taken into account in both groups.

However, the differences were not remarkable between these two groups resembling also the European level averages.

After Dolly

Gene Mutation

Wonderfood

Live and let die

Stem Cells

The Complexity Experience

Synthetic Biology

A Better Brain

Robo-beetle

Sneeze!

Allergies

Recreating life

Vaccine safety

miNDstake

Bechstein's Bat

Biomaterials

Puzzling Messages

2WAYS

Impact Survey