Evaluation Reporting Summary

Introduction

Expert evaluation was embedded throughout the Space Awareness project to rigorously test its effectiveness and identify its impacts on key target audiences, especially school teachers (and their pupils). The evaluation effort thus explored whether resources and activities were relevant and applicable to the various target audiences, including identifying key strengths and impacts. The intention in making the evaluation findings public is to further assist in creating a sustainable legacy for Space Awareness outreach efforts that will long outlive the project duration.

Our approach

The Space Awareness evaluation consisted of a multi-pronged strategy to both investigate the immediate impacts of the project activities, as well as create a baseline and follow-up opportunity for exploring longer-term impacts. Importantly, the evaluation framework was based on a set of common agreed intended outcomes for the various project activities. Much of the evaluation data collection was conducted by the project partners and dissemination nodes as they distributed the Space Awareness resources to local teachers and other educators, based on protocols and tools developed within the evaluation framework. The combination of a centralised framework and distributed data collection has resulted in consistent and comparable data collected from across Europe and beyond regarding activity impacts in areas ranging from the educational resources to face-to-face teacher training workshops to the Massive Open Online Courses (MOOCs). Additionally, a complementary qualitative fieldwork strategy, combined with dedicated online efforts and an international teacher competition, allowed a more in-depth exploration of specific issues within the final year of Space Awareness. For example, through these more qualitative approaches we were able to better explore the impacts of the Space Awareness tools on specific target groups such as girls, ethnic minorities and those from socioeconomically disadvantaged backgrounds. Teachers and other educators were also provided with their own assessment tools, consisting of both formative and summative techniques to help assess pupil learning in engaging and informative ways.

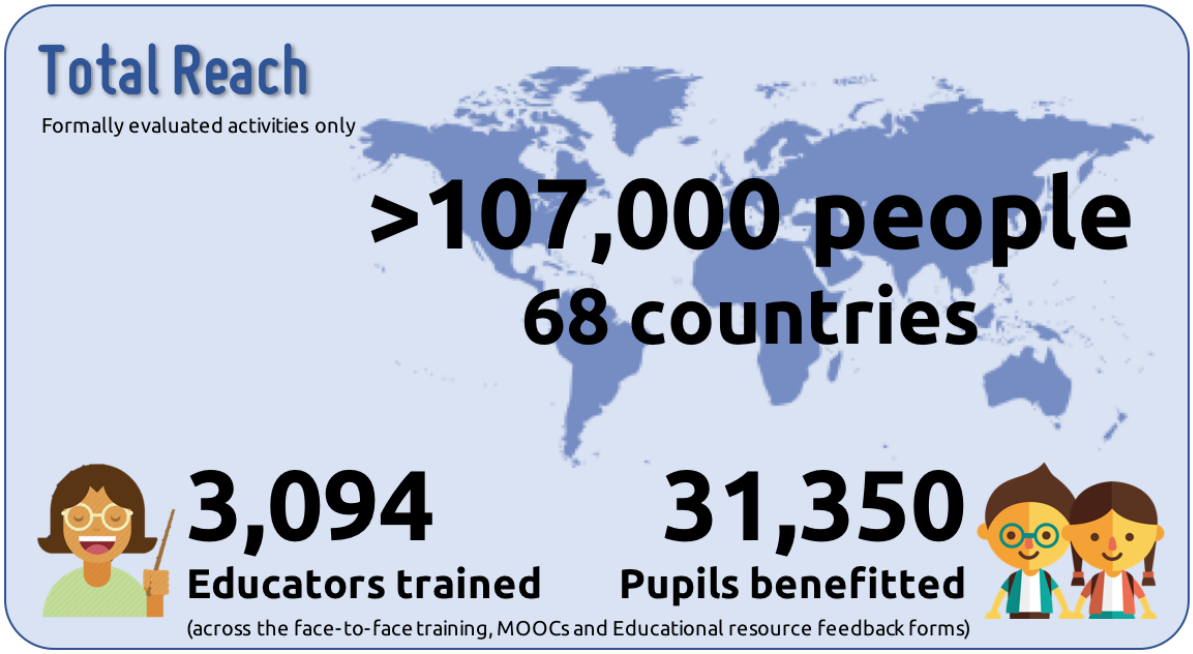
An important aspect of the evaluation framework involved the implementation of two large-scale Europe-wide surveys which enabled a baseline measurement of existing attitudes and opinions relating to space science. Covering both current pupils' and existing space scientists' experiences and perspectives, these surveys have for the first time allowed specific investigation of aspirations and influences relating to space science careers.

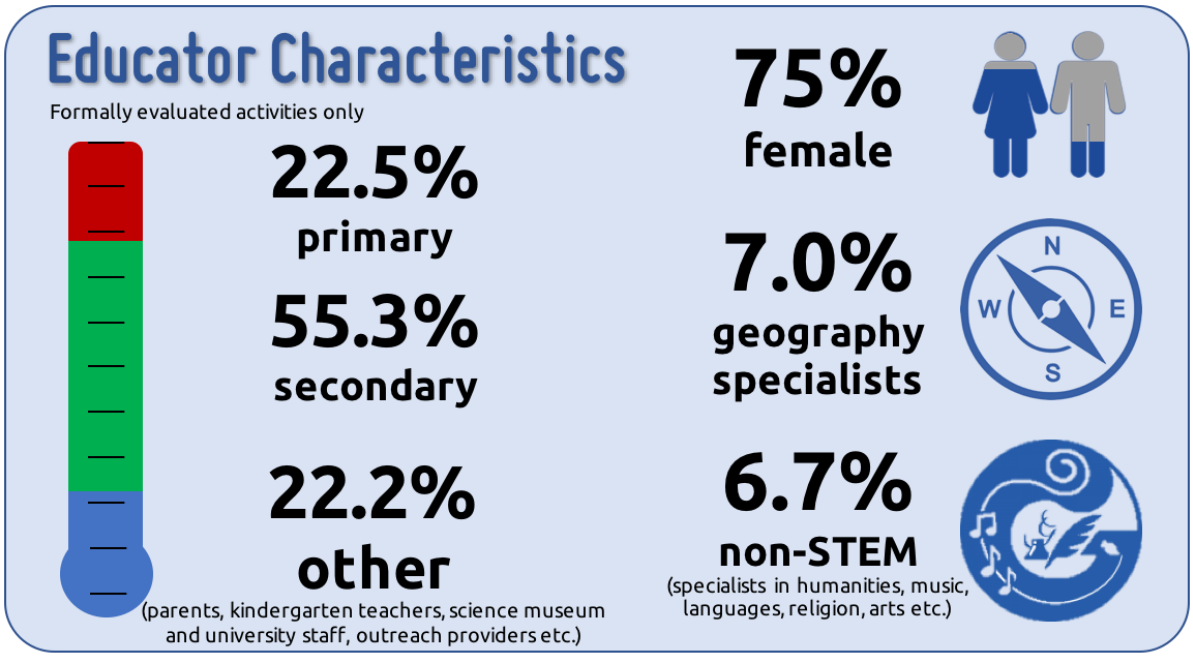
A further substantial achievement within the evaluation effort was implementing a longer-term strategy, involving inviting educators to register their contact details for potential involvement in follow-up research at a later date. Invitations to participate were distributed at every stage of the evaluation data collection processes, resulting in a broad pool of registered teachers and other

educators that will enable dedicated longitudinal follow-up to occur in due course (subject to appropriate funding). This is a rare and highly unique feature of the Space Awareness programme.

Further details regarding the various evaluation tools, protocols and analyses are contained within the individual activity reports indicated below, including copies of all surveys and other documentation used during data collection.

Space Awareness Evaluation in Numbers





Key Documents

D7.2 Final Evaluation Report

This official project Deliverable outlines the main findings of the Space Awareness project evaluation. The evidence collected in all the other individual activity reports is synthesised in order to identify over-arching reach and participation patterns, perceived quality, and the project's success in achieving the specified Space Awareness intended outcomes. For the benefit of future similar projects, key elements of success and the main challenges are outlined, leading to both strategic and practical recommendations relating to future policy and practice in space science education within Europe and beyond.

Space Science: The view from European school students

A survey of European pupils' views of space science was conducted in 2016 and early 2017 as part of the Space Awareness project. This summary report provides an overview of the survey and its main findings, particularly with regard to age, gender and country. Additional details of the data and analyses are included in a technical annexe.

Looking Back: Space scientists' reflections on career influences, paths and choices

Within this survey participants were asked to reflect retrospectively on what influenced their decisions relating to space and technical career choices. A total of 415 individuals working in space science from over 30 countries responded to our online survey, representing a wide range of backgrounds and roles. This report summarises the key findings, and pays attention to the timings and initial influences of respondents' interest in space science, as well as how that interest was maintained. There is also a section highlighting key patterns within their reported career paths, including how their career interests developed, and what choices and priorities were influential.

Inspiring the Educators: Summary of feedback relating to the teacher training workshops delivered by individual partners and nodes

34 teacher training courses were delivered between September 2016 and June 2017. Within this document the data collection and analysis procedures are explained, utilising both participant and workshop organiser perspectives, and focused mainly on questionnaire surveys. The main results are delineated according to the courses delivered, participant backgrounds, course ratings, outcomes achieved, and any evidence of the skills developed within the courses being embedded into the participants' ongoing professional practice. Finally, a series of recommendations are offered in order to inform the development of future similar training workshops.

Deep Impacts: A summary report of the evaluation findings from the Space Awareness Massive Open Online Courses (MOOCs)

The evaluation of the MOOCs combined detailed quantitative surveys (distributed pre-, post- and after a 2-month delay in order to explore likely impacts from the course) with an in-depth qualitative analysis of a single course, *Navigation Through the Ages*. (Full details of the latter analysis are available in the *Engaging Teachers* report indicated below.) Respondents' backgrounds and participation patterns are explored in depth within this report, including a remarkable 30% course completion rate (corresponding to approximately six times the international norm). The evidence relating to the very high perceived quality, and success in achieving all of the intended participant outcomes, is also presented. In particular, comparison of pre- / post- / delayed- survey responses enabled affirmation of distinct knowledge gains and key shifts in participants' attitudes, values, skills and behaviours which appear to be directly linked to the Space Awareness project.

Engaging Teachers: *Navigation Through the Ages* MOOC: Summary of qualitative evaluation via participant observation

Participant observation was used within the *Navigation Through the Ages* MOOC to augment the survey data and collect qualitative evidence in relation to the intended learning outcomes. Evidence was synthesised according to the major Space Awareness Intended Outcome themes: *Feel, Value, Understand, Do* and *Skills*. These data augment the findings from the aforementioned *Deep Impacts* report by adding images, statements, reflections and narratives to better reflect the participant voice within the evidence presented.

Educate & Inspire: Summary of feedback relating to the Space Awareness educational resources

Feedback was provided on 43 separate educational activities via 212 separate responses to an electronic questionnaire representing an excellent breadth of contributions across central, eastern, northern and southern Europe. This report describes the data collection methodology as well as the respondents' backgrounds. In addition to an overall rating, key quality indicators were used to evidence the respondents' generally positive reception of the resources developed. Other indicator statements enabled evaluation of the project's success in achieving the intended outcomes for both teachers and students. Finally, specific recommendations are identified in order to inform the development of similar future projects.

Winning Hearts and Minds: Highlights from pupil and teacher competitions run within the Space Awareness programme

This document presents inspiring case studies demonstrating the wonder, enthusiasm, and fundamental benefits to participants' attitudes, values, knowledge, skills and behaviours as a result of their involvement in the Space Awareness project. Each easy-to-read case study presents a snapshot of what can be achieved by teachers and pupils across the world who were inspired by Space Awareness resources and activities.

Networking Space: Analysis of online and social media traffic relating to the Space Awareness project

Based on data collected using standard (free) analytics tools, the main trends regarding the Space Awareness website and Facebook traffic are outlined. This includes an overview of key visitor usage patterns and demographics, evidence of the growth in participation over the duration of the project, and the reach and traffic flow.

Voices of experience: Education practitioner conversations at the *Mission to Mars* Summer School Marathon Greece, 2 - 7 July 2017

This report is designed to synthesise and reflect upon the experiences of practicing teachers and educators from across Europe. It is specifically designed to help contextualise the wider evaluation of the Space Awareness project resources and activities. The Space Awareness project targeted educators as users of project activities and resources and the conduits of change. This report explores some of the broader patterns from the point of view of educators as practitioners. They are the experts on the context they work within, and their voices are valuable evidence of the issues at stake. The key findings consider what works inside the classroom, what are the key challenges faced by teachers, and what networks, resources and/or continuing professional development opportunities are sought in order to support teachers within their professional practice.

D7.1 Evaluation Framework

Finally, although much of the content is superseded by the above reports, it is perhaps also useful to share the mid-term official project Deliverable associated with the Evaluation Framework. It included a brief introduction to the Space Awareness project generally, as well as the Evaluation Framework more specifically. The Space Awareness Intended Outcomes were also introduced, along with the ethical considerations and formal approvals processes undertaken to ensure appropriate data collection and management. Finally, the initial Evaluation Toolkit was introduced, comprising a coherent and consistent set of tools and instructions to enable robust evaluation of the main project activities as they were implemented by nodes and networks across Europe and internationally.

Key findings

The following reports detail the main findings from the project. A summary of the main focus and key findings is provided below for each report; readers are also encouraged to review the individual reports via the links provided for further detailed information.

D7.2 Final Evaluation Report

Space Science: The view from European school students

A Europe-wide survey was developed in order to gather baseline data on current students' attitudes and perceptions of space science (and science generally). 8283 current pupils aged 9-16 from across

Europe completed the survey. Encompassing 11 different countries (France, Poland, Portugal, Romania, Czech Republic, Bulgaria, Germany, Greece, Italy, Spain and a combined English-language effort from England, Wales and the Republic of Ireland), this survey was designed to provide the first large-scale investigation of school students' perceptions of space science.

Enthusiasm for space science was clear within our sample, suggesting that there is a very good foundation on which to build. Analyses highlighted that individual differences (e.g. related to personal experiences, other attitudes etc.) are more important than background (whether gender, age or country) in driving attitudes to space science. That said, younger students (particularly ages 9-11) expressed more positive attitudes to space science, were more interested in activities related to space science and were more likely to aspire to careers in space science, compared with older pupils.

However, substantially fewer students expressed interest in pursuing a career in space science. As with physics, and other related subjects, space science appears to be constructed as strongly masculine. This was perceived as problematic, particularly for the females in our sample.

Finally, while there are challenges in encouraging more individuals – and particularly individuals from more diverse backgrounds – into space science, the survey highlights that the field does seem to have a relatively positive starting point. In particular, not only are students interested in the field and space science topics but proportionally more seem to hold aspirations towards space science, compared with science more generally, and particularly the physical sciences.

Looking Back: Space scientists' reflections on career influences, paths and choices

A total of 415 individuals who work in space science from over 30 countries responded to our online survey, representing a wide range of backgrounds and roles. Participants were asked to reflect retrospectively on what influenced their decisions relating to space and technical career choices.

It is clear from these findings that initiatives to encourage individuals to consider space-related careers need to begin early (certainly by late primary school), and that girls in particular need to be offered a wide range of potential entry points to inspire their interest. Many initiatives identified as successful are relatively low-cost, and appeal to a wide age range, such as books and magazines (or their modern, online equivalents) or stargazing experiences.

Whilst teachers and parents/carers (especially fathers) have an influence in such decisions, those going into space careers appear to be primarily self-driven, with a wide range of personal, professional and wider societal priorities. In particular it is important to maintain individuals' (especially girls') confidence and self-belief, as well as their interest in the field.

Inspiring the Educators: Summary of feedback relating to the teacher training workshops delivered by individual partners and nodes

Between September 2016 and June 2017, 34 teacher training courses were delivered within the Space Awareness project, reaching over 480 educators across 15 countries. In total, at least 22,152 students were reported to receive a direct influence from Space Awareness due to their teachers' participation in the training workshops. The majority (59%) were secondary school teachers, and a further quarter (27%) from primary level. There was some success in reaching beyond the traditional sciences, with over 10% of respondents specialising in subjects outside STEM – in particular geography (7%) but also music, economics and other (mainly humanities) topics.

Standardised pre-/post- teacher surveys combined with feedback from workshop organisers were used to evaluate the impacts of the teacher training workshops. Overall they were perceived to be of very high quality: over 99% of participants rated the workshop they attended as at least "Good", with at least 50% in every country giving the highest rating of "Very good". Compared to their wider cohorts, the courses were particularly well received by geography teachers and females, with at least 80% in each case giving a rating of "Very good", suggesting that the project succeeded well in targeting these groups. Overall, 98% of respondents would both recommend the course to a colleague or friend, and also be interested in participating in a similar course again.

Perceived strengths focused on the practical nature of the activities, and the quality and specific content of the tools and resources provided. Teachers also spontaneously reported other key aims of the workshops as important success factors, for example enhancing teachers' ICT and inquiry skills, raising their awareness of the cross-disciplinary relevance of space science, or providing an opportunity to share ideas (especially with other teachers, including those from outside their own specialism). Courses that were 90-minutes or shorter tended to leave participants feeling that they hadn't been able to fully engage with the content (especially the practical activities). Teachers also reported wanting more explicit links between the activities and their local curriculum, as well as more activities for younger or lower ability students. In certain countries the lack of availability of resources in the local language was a frustration to teachers and workshop organisers alike.

Both quantitative and qualitative feedback from participants indicated that the courses had impacted on them (and/or their students) across a range of emotional, attitudinal, behavioural, intellectual and skills-based domains. Despite fairly high levels of reported confidence prior to the course, there were notable increases in participants' familiarity and/or confidence with space science careers, inquiry-based teaching approaches and strategies for managing diversity in the classroom. Building on the findings reported here, ten recommendations have been developed to help inform future similar programmes; see the full report for further details.

Overall these results were extremely positive. There is evidence that all of the intended priority outcomes were achieved within the teacher training workshops, and that they are likely to have encouraged a shift in the everyday practice of teachers across Europe (and beyond). There is already evidence of subsequent impacts on learners' individual experiences which will be beneficial far beyond the life of the project.

Deep Impacts: A summary report of the evaluation findings from the Space Awareness Massive Open Online Courses (MOOCs)

A series of pre-, post- and follow-up surveys (conducted two months after the end of the course) enabled direct comparison of participants' self-reported attitudes, values, skills and perceptions. A total of 4,059 registrations (corresponding to 3,165 unique individuals) were received across the four MOOCs. The course completion rate here (~30%) was approximately six times higher than the international norm, suggesting that the Space Awareness MOOCs were far more successful than other equivalent courses in retaining participants until the very end.

The course participants represented 68 different countries and a very wide range of backgrounds. There was particularly strong representation from Southern Europe (especially Italy and Greece) and Eastern Europe (especially Romania), representing 82% of respondents in total. The majority of participants were female (>70% for all four courses), worked as secondary school teachers (>55%) and

had extensive previous experience working in education (>50% for at least 15 years). In line with the wider aims of the Space Awareness project, there were clear successes in recruiting teachers at primary level (approximately 20% of the overall cohort), as well as those from outside traditional science specialisms, including various humanities subjects and those associated with English language teaching (approximately 6% in total).

The overall course ratings were very positive: for the combined dataset over 99% of respondents gave a rating of at least "Good", with over three-quarters giving the top rating of "Very good". Almost 80% of respondents strongly agreed that they would participate in another similar course again, with females being statistically more likely to 'Strongly agree'.

When asked what they enjoyed most about taking part, participants were most positive about the course content. Participants felt they gained access to new resources or ideas for their practice, as well as specific knowledge and/or activities. Respondents were also very complimentary about their interactions with other participants, frequently describing the MOOC atmospheres as 'collaborative' and containing a strong 'community spirit', and appreciated the opportunity to interact with other teachers from all over the world.

Conversely, though generally positive overall, at least 10% of respondents reported encountering "significant" problems which prevented them from "making the most of the course" related to three key areas. These were (1) technical problems (most commonly with the Learning Designer platform), (2) language issues (related to the resources only being available in English), and (3) the timing/duration (both of the course overall as well as specific aspects such as the perceived short deadline for the final submission).

Knowledge ratings became much higher post-course for every area of knowledge covered within the three subject-specific MOOCs. The most noticeable shifts occurred in more specialist topics, for example different ESA missions, exoplanets and celestial objects. In these cases, the proportion of people who felt they understood 'A lot' or 'some' of each concept raised from around 30-40% to 70-90%. Our Fragile Planet was also reportedly very effective in communicating about space careers: prior to the course fewer than 50% of respondents felt they knew more than 'A little' about different space career opportunities, but this rose to 98% post-course.

The Space Awareness MOOCs appear to have been particularly successful in building up female participants' confidence and supporting their knowledge development. For every one of the 17 knowledge-related questions asked prior to the course, males on average reported a higher level of confidence in their understanding than their female counterparts, with six of those statements displaying a statistically significant difference by gender prior to the courses. However, none of these statistical differences remained after the courses, and females (on average) expressed greater confidence than males for 7 of the 17 questions in the post-course surveys.

Engaging Teachers: *Navigation Through the Ages* MOOC: Summary of qualitative evaluation via participant observation

Participant observation was used within the *Navigation Through the Ages* MOOC to augment the survey data and collect qualitative evidence in relation to the intended learning outcomes. Data from observation included both content and interaction visible through a normal participation experience. This included: participants' posts to set questions, learning diaries, a recorded Teachmeet and

webinar, Facebook posts, and assessed lesson plans. Anonymised data was also collected through private email and chat channels.

Evidence was synthesised according to the major Space Awareness Intended Outcome themes: *Feel, Value, Understand, Do* and *Skills*, augmenting the findings from the aforementioned *Deep Impacts* report by adding images, statements, reflections and narratives. What emerged from the rich data was that space science is well positioned to engender inspiration, enjoyment, curiosity and wonder, and that the MOOC resources successfully deliver this emotional connection. Educators felt confident about teaching the topics covered in *Navigation Through the Ages* and there was evidence in the learning diaries that they emerged from the course with a valuable set of resources. Discursive and inquiry-based activities appear to have been effective in allowing consideration of attitudes and values in relation to science and culture, citizenship, diversity, and relevance.

Additionally, the observed participants could be usefully segmented into four groups, based on the particpants' motivations for taking part in the course and their professional role and responsibilities: (1) Interdisciplinary Advocates – teachers motivated by interdisciplinary innovation; (2) Strategic Developers - teachers with management and curriculum development responsibilities; (3) Outreach Experts - educators affiliated to national and local astronomy institutions and astronomy groups; and (4) Classroom Enthusiasts - classroom teachers in search of CPD, an extended network and inspiring resources.

Educate & Inspire: Summary of feedback relating to the Space Awareness educational resources

Feedback was provided on 43 separate educational activities via 212 separate responses to an electronic questionnaire representing an excellent breadth of contributions across central, eastern, northern and southern Europe. Primary teachers were the most common respondents, representing approximately half of the cohort. Secondary school teachers were also well represented (41%), with a small number of contributions from informal educators (museum and science centre staff, astronomy club volunteers and the like, 4%) as well as other external roles (such as trainee teachers or university staff, 5%). The vast majority of respondents were STEM (science, technology, engineering and/or mathematics) specialists, though in line with the Space Awareness aims to encourage uptake of space science across the school curriculum it was pleasing to see respondents with language and other humanities (history, religion etc.) backgrounds involved.

The overall ratings for the evaluated resources were generally very positive: half of the respondents gave a rating of 9 or 10 (Excellent), and more than 92% gave a rating of 7 or more. Breaking this down by the individual resources, it is clear that there is no consistent pattern for any particular resource – they all exhibit a range of ratings, suggesting that no single resource was particularly poor or outstanding. Primary-level activities were statistically more likely to receive higher rankings than those designed for secondary school students ($p=0.012$).

In terms of "what worked well", a wide variety of themes emerged, most notably relating to the "hands-on" nature of the activities, the high quality of the background materials (including the scientific content and images/visuals used), and the resources' success in explaining abstract or complex concepts. Regarding potential improvements to the resources, many of the respondents' suggestions (47 of 125 received) were very specific, detailing particular suggested modifications, or aspects they would do differently themselves in the future.

Overall these responses suggest that the activities were judged by the majority of participants (especially primary school teachers) to have been influential in achieving the intended teacher- and pupil-oriented outcomes. There were some notable areas where the evidence of success was slightly weaker, in particular careers-related aspirations, and connections to ICT usage.

Winning Hearts and Minds: Highlights from pupil and teacher competitions run within the Space Awareness programme

To showcase outstanding practice and celebrate both teacher and pupil achievements, two international competitions were run within the Space Awareness programme, the *Celebrating Excellent Space Science Teaching* competition for educators, and the *Space Scoop Comic Contest* for pupils. The case studies within this document are designed to (1) highlight examples of outstanding contributions; (2) celebrate the efforts and impacts of the competitors; and (3) inspire the future practice of other educators based throughout Europe and beyond. The case study selection in each case was based on a complementary selection of winning and international finalist entries, showcasing diversity in terms of audiences, approaches and geographical regions.

Celebrating Excellent Space Science Teaching Competition – Educators from 13 participating countries (plus a global contest for any entries not covered by an existing national version) were invited to describe what (and how) they used Space Awareness resources in their teaching. The entrants were asked and present evidence of how their efforts had worked in practice, in particular any noticeable impacts on their students, as well as key learning points they wished to share with other educators. Submissions were invited for two categories, corresponding to key priority intended impacts within the Space Awareness programme:

- A: Inspiring young people from diverse backgrounds with space science
- B: Supporting young people to become aware of space-related careers

The final case studies are:

- *Brazil:* training learners to inspire other learners
- *Rural Crete:* enabling new horizons by supporting rural young people to become aware of space-related careers
- *Greece:* enabling diversity in project work at a bilingual Muslim school
- *Tamil Nadu in India:* feeding curiosity by sharing knowledge using inquiry-based learning approaches
- *Trichy Region in India:* using career videos of space scientists as a catalyst for change within a slum community
- A collaborative initiative by teachers in *Italy and Croatia* showcasing learning across borders
- *Nigeria:* using local historical astronomical knowledge to engage young people with space science

The *Space Scoop* Comic competition – Young people between the ages of 8 and 18 years were invited to create an original comic based on one of the Space Scoop news stories. The four international winners, as well as three complementary national winners, are showcased in this report to highlight evidence of pupils' engagement with space science through the Space Awareness project.

The case studies explore some intriguing perspectives, for example:

- *Bulgaria:* making space science cool and subverting stereotypes with humour

- *Indonesia:* a journey of emotions: the lure of space and the unknown
- *Iran:* the wonder of space exploration, world citizenship, and international collaboration
- *Japan:* melding art and science: insights into how engagement is experienced
- *Poland:* from the known to the unknown making sense of strange facts
- *Romania:* the bigger picture from space, our earth and the audacity of hope
- *United Kingdom:* science facts and fun graphics on Extra Telestrial Vision TV

Networking Space: Analysis of online and social media traffic relating to the Space Awareness project

Overall, the website and Facebook analytics suggest that both platforms succeeded in engaging online users from a variety of geographical locations with the Space Awareness content. Within the past two years a total of 61,743 people visited the website, and 1,521 'liked' the Facebook page, with both values increasing substantially over the course of the project. There was a predominance of females within the Facebook followers, suggesting that the social media efforts were important in supporting a key target audience for the Space Awareness programme.

Voices of experience: Education practitioner conversations at the *Mission to Mars* Summer School Marathon Greece, 2 - 7 July 2017

This qualitative study explores key insights on teachers' experiences from practicing experts. There was a great deal of agreement on what works inside the classroom, the key challenges faced by teachers, and in what teachers said about their own professional development processes and opportunities. However, there were notable regional differences between teachers' knowledge of EU-funded development opportunities and resources.

There was consensus that 'what works' are resources and activities that encourage discussion and action, that the teacher can adapt for their own local teaching context. Examples of this consensus centred around two themes. First, the teachers' expertise in *facilitating learning*, and second, opportunity and means for *adapting the curriculum*.

On the theme of *facilitating learning*, the delegates proposed that effective teachers encourage learners to rethink their preconceptions about what counts as science and the relations between the science disciplines and mathematics. In examples demonstrating skilled questioning and judgement, the delegates described how they guide learners to make connections between science lessons taught at school and science in everyday life, in the news and in the world around them. On the theme of *adapting the curriculum*, delegates talked about inclusive strategies and activities that are relevant to all and not just for those interested in science-related careers. One example of this was described as 'storifying' the curriculum which involves: a dramatic storyline (e.g. *Mission to Mars*, or an alien object on a collision course with Earth), and scenario-based learning activities (e.g. planning a mission, and evacuating planet Earth). Another example was described as a 'problem-based collaborative group project' which involves: teams that are set an open-ended problem such as designing a space suit, and a target project goal (e.g. an exhibition, or entering an international competition).

There was agreement that 'what is challenging' centres around *systemic constraints*. One example is the tension between teaching science relevant to the learner, and the demands of testing that leave little time for discussing real world examples. Yet upper secondary science teachers also argued that

older students who have chosen to study science want more challenging science, so that relevance is constructed in relation to a science problem. Another systemic constraint that was discussed by the delegates, is that the science curriculum is separated into disciplines and teachers said they found it difficult to reconcile this with real world science projects. Finally the challenges of presenting science as a creative endeavour, with opportunities for discussion and debate were perceived as different from the humanities and arts subjects and offered as a reason why learners disengage with science.

In terms of what delegates said about professional development processes and opportunities, there were perceived differences between teachers from northern Europe compared to south and east Europe, with regards to access to information about EU-funded opportunities. Alongside this it was clear that delegates valued enrichment activities including: conversations that offered pan-European perspective on science education and space science, the opportunity to network with colleagues from other regions both online and face-to-face, and access to space ambassadors.

D7.1 Evaluation Framework

Finally, although much of the content is superseded by the above reports, it is perhaps also useful to share the mid-term official project Deliverable associated with the Evaluation Framework. It included a brief introduction to the Space Awareness project generally, as well as the Evaluation Framework more specifically. The Space Awareness Intended Outcomes were also introduced, along with the ethical considerations and formal approvals processes undertaken to ensure appropriate data collection and management. Finally, the initial Evaluation Toolkit was introduced, describing a coherent and consistent set of tools and instructions to enable robust evaluation of the main project activities as they were implemented by nodes and networks across Europe and internationally.

Acknowledgements

The Space Awareness Evaluation was led by Dr Karen Bultitude (University College London, UCL), who also took responsibility for the majority of the quantitative investigations relating to specific activities, including the Educational resources, face-to-face training workshops, the MOOCS, and the online and social media analyses. Dr Jennifer DeWitt (UCL) contributed to the initial development of the Evaluation Framework and oversaw the longitudinal components, especially the two baseline surveys (concerning pupils and current space scientists respectively across Europe). Catherine Aldridge (UCL) built on existing best practice and liaised extensively with the project partners and nodes to develop the Space Awareness Intended Outcomes and the initial structure of the Evaluation Framework. Uma Patel (UCL) was responsible for many of the qualitative investigations, in particular the participant observation and analysis of the *Navigation Through the Ages* MOOC; the field work on the experiences of practicing teachers and educators from across Europe at the *Mission to Mars* Summer School in Greece; and the development of the strategic case studies building on evidence from the international pupil and teacher competitions conducted within the project. Emma Pegram (UCL) provide expert input in drafting some of the initial quantitative tools.

Substantial input was provided by other project partners relating to specific activities, for example Audrey Korczynska (University of Leiden, UL) in the development of the Evaluation Framework and associated data collection tools; Jorge Rivero Gonzalez (UL) in the implementation of the *Celebrating Excellent Space Science Teaching* competition; Sarah Roberts (UNAWE) and Edward Gomez (Las Cumbres Observatory) in the implementation of the *Space Scoop Comic Contest*; Adina Nistor

(European School Network, EUN) for all matters relating to liaising with the partner and nodes network; Eleftheria Tsourlidaki (Ellinogermaniki Agogi), Teodora Ioan (EUN), Sara Anjos (NUCLIO) and Evita Tasiopoulou (EUN) in the development and implementation of the MOOC evaluations as well as the formative and summative assessment tools developed for direct application by teachers; and Nigel Mason (Open University) and Anita Heward (Europlanet network) for their strategic assistance in recruiting participants to the retrospective scientist survey. Wouter Schrier (UL) and Anastasiya Boiko (EUN) provided essential assistance in finalising many of the evaluation reports for public release. We are also grateful to the various competition organisers and judges at both national and international levels who greatly assisted in celebrating teachers' and pupils' successful engagement with the Space Awareness resources.

Additionally, we wish to acknowledge the very important contributions of the various partners and nodes who oversaw the dissemination of the Space Awareness activities and resources and managed the data collection processes at local level . In addition, all the people who undertook translations of resources and competition information played a fundamental role in ensuring the Space Awareness resources could reach as wide an audience as possible.

The most important stakeholders in the Space Awareness project are the teachers, educators and pupils. We express our deep gratitude to all those who generously contributed feedback, suggestions and reflections on their experiences. Your efforts have been a tremendous help in determining the impacts of the Space Awareness project, and offer an invaluable contribution to ongoing space science education throughout Europe and beyond.

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