Results from the Royal Society Summer Science Exhibition visitors' survey

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In order to evaluate the effectiveness of communication at our stand, 'A Model Earth', at the Royal Society Summer Science Exhibition (3rd to 9th July 2017) and to observe trends in opinions and knowledge of climate science amongst exhibition visitors, a survey was conducted over the course of the exhibition week. The aim was to compare answers to a selected number of questions on climate change, what we called '*opinion questions*' (example question included; what role have humans played in climate change?, how will climate change affect humans?, and what is society doing to combat climate change?) with a second set of questions that tested the knowledge of exhibition visitors about the science of Earth system modelling and current levels of global warming, what we called '*knowledge-based questions'*. These questions were compared stratified by age, level of education, and whether they had visited our stand, 'A Model Earth' at the point when the questions were answered. Such a study was party conducted due to interest and partly to help determine whether our method of communicating our research at the stand was effective and appropriate to the knowledge level of the general public.

RESULTS

175 respondents completed the survey, 164 above the age of 14 (see age distribution in Fig. 1A). Because of the low number of people under 14 who took our survey, the subsequent analysis and conclusions are based on those surveyed above the age of 14.

Regarding the first set of '*opinion questions*', there was a strong majority of 94.5% who believed climate change was occurring as a result of human activity (Fig. 1B). The age distribution was slightly more diverse in answer to the question '*Do you think that you will be directly affected by climate change within your lifetime?*' (Fig. 1C). Whilst 93.9% of respondents believed that they would be affected in some respect, there was variation between those who thought they 'would be affected in some ways', and those who thought that climate change would 'have a major impact' on their life. Markedly, the 60+ age group were less likely to believe that they would feel major impacts of climate change within their lifetimes. The proportion of over 60s who answered '*Yes, I think it will have a major impact on my life*' was greater than 10% lower than any other age group (20.7% of the +60 group compared to 33.3% and 37.3% for 14-29 and 30-59 age groups, respectively). Likewise, the proportion who answered '*No, I don't think climate change will have an effect for some time to come*', was over 10% higher than other age groups (13.8% of the +60 group compared to ~2.5% for 14-29 and 30-59 age groups).

A slightly lower majority of 76.8% believed society could do more to combat climate change. The opinion, '*No, I think we can do more',* was the preferred answers by all age groups (Fig. 1D). However, the group of +60 again showed a marked difference with the other groups when choosing '*Yes, I think we're doing the best we can for the time being*', with higher number of answers than all other groups (20% of the +60 group compared to 4.9% and 2.0% for 14-29 and 30-59 age groups, respectively).

Whilst also a representation of age and therefore individuals foreseeing less time for the climate to change within their lifetimes than, for example, a 15 year old, this could also suggest a more widespread belief that climate change is a future concern rather than something that is affecting humans in the present day. Moreover, the increased number of responses in the +60 group feeling that efforts currently being made by society to address climate change are not that bad, could also be attributed to life expectancy, as this group may be more likely to consider other aspects where they feel societyshould focus more , such as health care or pensions.

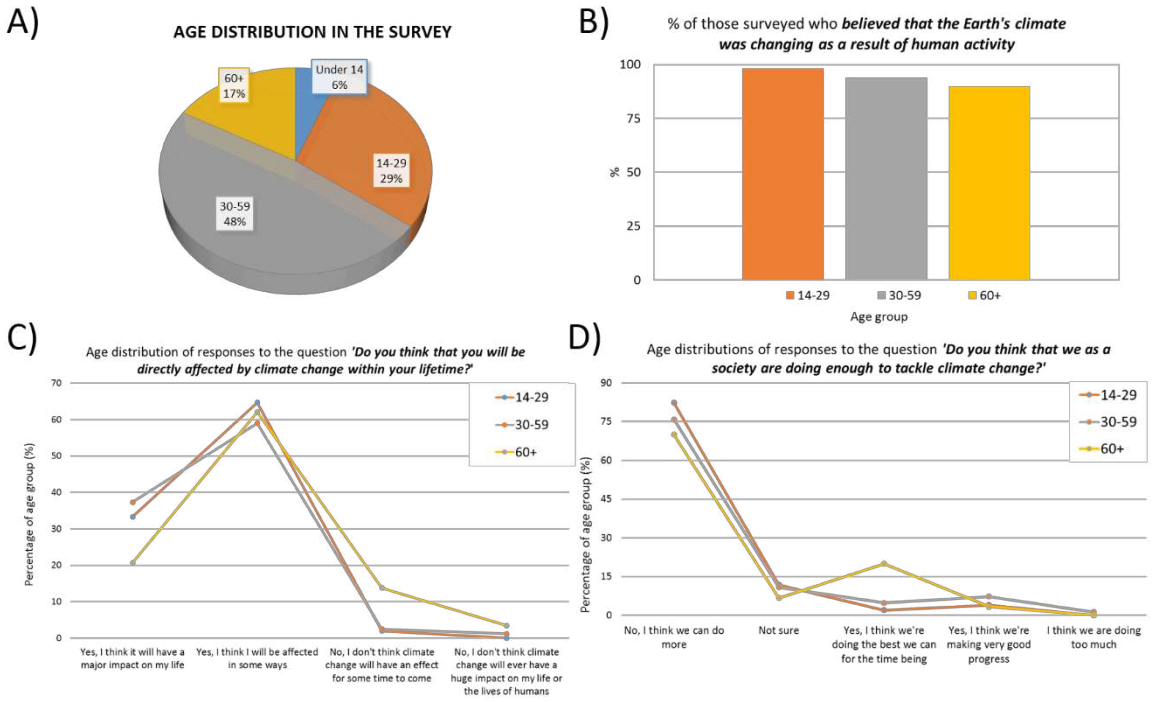

Figure 1. A): Age distribution of the 175 visitors who took the survey. B): Percentage of positive answers to the question '*Do you believe that the Earth's climate is changing as a result of human activity?*' C) and D): Age distribution of the responses to the questions '*Do you think that you will directly affected by climate change within your lifetime?*' and '*Do you think that we as a society are doing enough to tackle climate change?*', respectively.

Meanwhile, certain knowledge-based questions showed a higher proportion of correct answers. 75.6% of respondents correctly answered that the Earth had seen approximately 1°C of warming over the past 100 years. In contrast, only 28.7% of respondents correctly answered which components of the Earth were included in an Earth system model. This suggests that whilst the public is relatively well exposed to the facts of global warming, their understanding of climate science and the methodology behind the research, in particular climate modelling, is much lower (Fig. 2A).

Whilst the survey results show no significant difference between opinions expressing concern about climate change, of those who had visited the stand and those who had not, there is a slight improvement in the proportion of respondents who answered all of the knowledge-based questions correctly (Fig. 2B). 60% of those who had not visited the stand answered 2 or more questions correctly, with 17% answering all 3 correctly. This compares to 65% of those who had been to the stand receiving 2 or more right answers, and 22% with all 3 correct. While this is only a small increase, the knowledge and scientific understanding of the visitors to the exhibition was already high prior to arriving at the exhibition, hence their

interest in attending. An example of this was when we compared the correct number of answers to our knowledge-based questions based on Educational level of the respondent. Results showed how the number of people who answered 2 or more questions right increased with their level of education, with higher numbers of correct answers in the groups of respondents with postgraduate and undergraduate degrees (Fig. 2C).

Whilst 'A Model Earth' may not have significantly influenced the opinions of many exhibition visitors, the results suggest that communication was effective enough to have slightly improved average understanding of climate science.

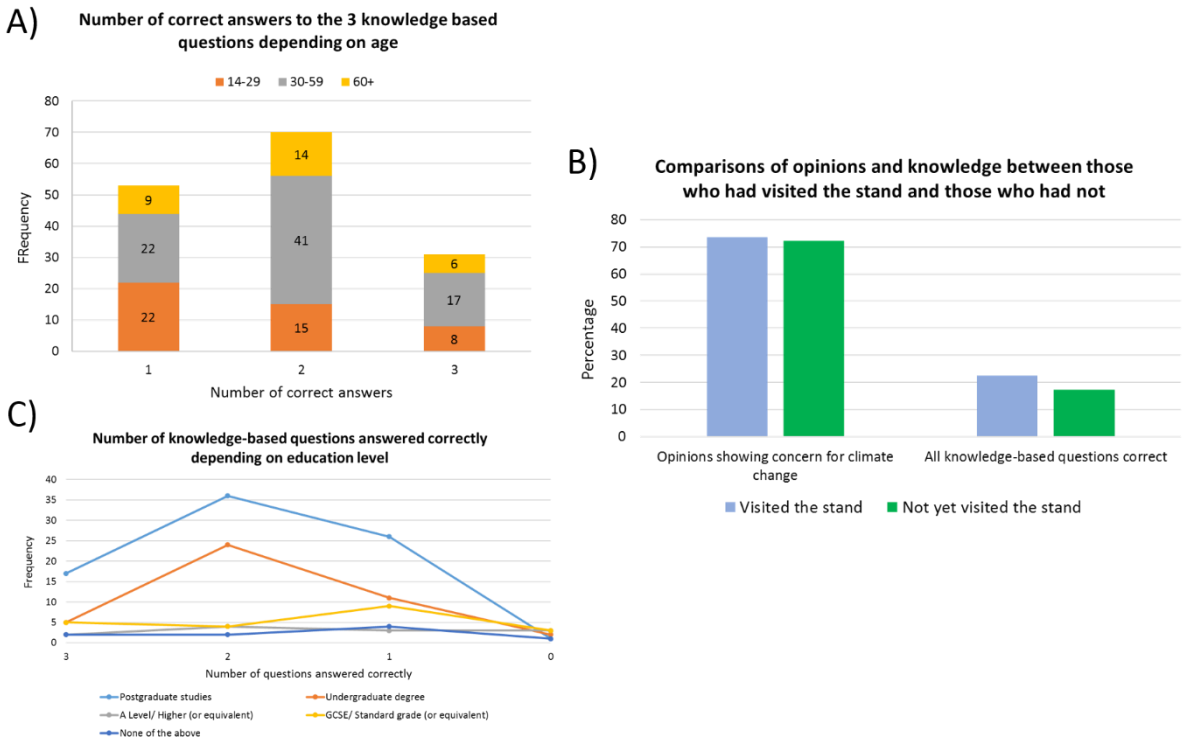

Figure 2. A): Cumulative number of correct answers to the 3 knowledge-based questions across age groups. B): Differences between the responses of those who had visited 'A MODEL EARTH' stand compared to those who had not. C): Comparison of the number of correct answers to the knowledge-based questions depending on the educational level of the exhibition visitors.

CONCLUSIONS

The results of this survey suggest the public have a relatively good understanding of global warming and have concerned opinions surrounding climate change, although the sample was biased towards a more educated audience due to the nature of the Royal Society exhibition (i.e. those likely to attend such an event are likely to have an interest in, and therefore a certain level of understanding of science in general and potentially a decent exposure to climate science). However, the results do show a difference in opinions over how rapidly the impacts of climate change will occur, depending on age, and also suggest that public understanding of climate modelling or Earth system models is very low. The feedback from the survey shows that visitors found our stand enjoyable and the slight improvement in answering the knowledge-based questions after visiting the stand suggest

that communication of concepts was good and that the team was engaging. A limitation of the methodology could potentially be the presence of multiple-choice that may mean respondents had an opportunity to guess and still get the answer right, meaning that the total number of correct answers may have been affected as a result. If the survey was repeated then a larger, more diverse sample size might be preferable as it may be more representative of the whole population. A greater number of questions would also allow better analysis of public understanding, although due to the nature of the event this is likely unwise as visitors are unlikely to want to answer a long survey.

METHODOLOGY

The survey was carried out on a mobile tablet using an app called 'Quick Tap Survey', which worked offline and then collected the results in a single database. In order to cater for different ages and whether respondents had visited our stand, the survey used branching, where different answers to certain questions, determined which question followed. Respondents under the age of 14 were also offered an alternate set of questions which were more appropriate for their level of understanding. As well as ensuring that no-one was excluded from the survey, it also maximised the number of visitors who were likely to answer the survey as parents are more likely to join in if their children can also be involved. Respondents were selected randomly from the visitors to the exhibition, both in the building and in the queue outside. All ages, genders and ethnicities were approached for the survey.

The following questions were asked: