TOPIC: COMMUNITY SCIENCE APPROACHES

SUB-TOPIC: PART B: COMMUNITY SCIENCE & WATER QUALITY

Supporting Transcript

PRESENTED BY: Sam Addison, The University of Manchester

CONTENT COORDINATOR: Dr. Laura Richards, The University of Manchester (Department of Earth and Environmental Sciences)

This transcript accompanies associated presentation slides and video content developed for the TIDE project in 2021, with acknowledgements and disclaimer as noted in associated files.

Slide 1

Hello, my name is Sam Addison and welcome to this lesson on community science approaches. The lesson community science approaches is a two part lesson, and Part B which is this lesson will be on community science and water quality.

Slide 2

In this lesson we will have a brief introduction and discuss the objectives of the lesson. We will then have a section talking how community science can be used in the study of water quality and will look at a case study using community science in a water quality research project. Following this, I will then introduce some learning exercises focused on the lesson, that you may wish to talk part in to further your learning.

Slide 3

This lesson will develop on from community science approaches part A where community science was introduced. In part B we will use the knowledge developed and apply it to look more specifically at water quality.

Slide 4

The objectives of this lesson are to firstly be able to discuss reasons as to why community science may be useful within the study of water quality. The second objective is to be able to illustrate an example of water quality community science and the final objective is to be able to assess the benefits and limitations of community science for water quality research.

Slide 5 – Section Break

Slide 6

As we discussed in part A of the 'Community science approaches' lesson, community science has key benefits that may align with current challenges within water research.

Firstly, there can be large gaps in data both spatially and temporally in water science, therefore there is an increasing demand of new approaches to attempt to close the gaps in data.

Secondly, there often exists a gap in water awareness between the public and the specialist knowledge of scientists. This can apply to water quality in particular, where the public may be unaware of the quality of their water and the risks poor water quality may have.

Community science may be useful in this context as it firstly provides an efficient and cheap method for data collection and also is able to simultaneously support knowledge exchange, therefore potentially providing a contributing solution to the two issues.

Slide 7 - Section Break

Slide 8

Patna District in Bihar, India is a location that was identified to being a suitable location for a community science programme to research water quality due to our University of Manchester's team ongoing research in the area through a NERC-DST Indo-UK Water Quality project.

Areas such as Bihar in the Indo-Gangetic Basin of India can have high levels of arsenic contamination in water sources used for drinking. Some studies have suggested that many people place low value on arsenic-free water, generally consistent with a lack of public awareness.

Slide 9

The aims of the community science study in light of the background of the situation in Patna District, Bihar was to involve public members into a scientific study to raise awareness which would in turn potentially lead to an increase in the value placed on arsenic free water.

Whilst raising awareness, as identified, community science allows for efficient data collection and so more water quality information will be collected which could collect data where data has not been collected before.

Slide 10

The project had 5 key stages. The first stage was to communicate and arrange visits with schools and universities in Patna District, Bihar, India. Following this, the schools and universities that agreed to be a part of the project were visited and students at each school or university were provided with a lesson on water quality and more specifically arsenic contamination. Students were provided with the necessary equipment and knowledge to collect groundwater sourced drinking water samples along with information on the sample they collected, which included information such as the location where they collected the water, the depth of the groundwater source and if the drinking water had gone through water treatment. The samples were analysed for chemical contaminants with a primary focus on arsenic. The final step which is yet to be completed is to provide the results to the volunteers of the project along with further information to allow them to further learn on the surrounding topics.

Slide 11

If we take a closer look at the sample collection and analysis, we can see there were more steps involved and important considerations.

Firstly, when the volunteers collected samples, a priority was their safety and so, samples were collected in a safe manner. To do this, samples were collected from a source that was easily accessible and they knew was a regularly used source of drinking water, for many this would mean that they collected from their homes. Additionally, the task of sample collection was to simply collect the water and no additional steps were needed such as acidification in order to prioritise the heath and safety of volunteers. The samples were transported to the University of Manchester in the United Kingdom and before transportation the samples were package securely to avoid accidental spillage of the samples.

Samples were prepared and analysed in the laboratory and were analysed for chemical contamination which included chemicals that can lead to human health concerns such arsenic and fluoride.

During the sample analysis, quality checks were put in place and these were checked after the analysis was complete. The checks included duplicate sample analysis where samples were analysed twice to see that the analysis was leading to results being consistently measured at similar levels. Blank samples were used by using deionized water and check that contamination of the samples was not occurring. Finally, certified reference materials were used which are samples with known concentrations and so by analysing the sample we would know if the sample analysis is accurate by being similar to the known concertation.

Slide 12

The project led to 5 schools and universities being visited and involved in sample collection. The volunteers from those 5 schools and universities collected a total of 484 groundwater samples and along with samples collected data on the depth of the source, if the water was treated and the location of the sample.

The total number of samples shows how efficient the method of sample collection was and as the majority of volunteers collected one sample. It shows how many volunteers were involved and made aware of the importance of water quality.

Slide 13

The location of where the samples were collected is shown in map A. The different colours represent which school or university the volunteer belonged to that collected the sample. Map B shows where Patna District, Bihar is in India. The distribution of the samples shows how the volunteers collected the samples mainly in two areas and these two areas are where the schools and universities were located. But samples were also collected at further distances.

Slide 14

As we measured the samples for arsenic concentration and the samples were collected with a location, it has allowed for the creation of a map showing the distribution of arsenic in the samples collected. The arsenic data has been split into three categories of 0-1 ppb, 1-5 ppb and 5+ ppb. Within the data it can be seen that trends are present and along with additional information such as the concentration of other chemicals allows for an interpretation of the controls of arsenic contamination in Patna District of groundwater.

Slide 15

As discussed in part A of the community science approaches lesson, data validation is an important step in community science projects as it allows for volunteer collected information to be checked if it is accurate.

The ways in which data validation was used in this study was firstly to compare the samples that were reported to be collected at similar locations. By doing this we could see their variability and whether volunteers were collecting samples similarly to each other.

Another step was to check the reported locations and verify if they were locations that were likely to have been a sampling site. In some cases the reported location was an area that would have been inaccessible to collect a sample, in those cases the sample and its location would be avoided.

Finally, the results of the study were compared to other studies within Bihar. As multiple analytes in addition to arsenic were measured, ongoing work is to compare this to other studies and to see if their results shared similar trends and patterns.

Slide 16

The results gathered allow for 400 plus volunteers to be provided with accurate water quality information, regarding the concentration of arsenic and fluoride in the drinking water they collected.

A follow up report from the project is in progress which will provide further information and recommendations based on their water quality data.

In the future further co-design of the project with teachers and students is a beneficial idea. This would allow for the project to align with the curriculums of the students and provide more benefits to them as it could become a larger part of their learning and allow them to focus more on the project.

Slide 17

The study highlights that community science is a good way of collecting water quality data efficiently through engagement with interested schools/universities. The study shows that community science has the potential to raise awareness whilst also conducting scientific research. Further work is needed with regard to comparison to other water quality studies in Bihar. Future work would aim to monitor and evaluate engagement and impact throughout the project

Slide 18 – Section Break

Slide 19

Overall, from this lesson, there are 3 key take home messages. Firstly, the application of community science approaches to water quality offer substantial potential for future projects. Secondly, community science has been used as an efficient method to survey groundwater arsenic contamination in Patna District, Bihar. And finally, ongoing work is needed to evaluate and interpret the data, and relative strengths and limitations, including in comparison to other studies in the area.

Slide 20 – Section Break

Slide 21

For the learning exercise as part of this lesson, it is to try and design your own community science focused study to investigate water quality. When designing the project there are three important things to think about. Number 1, how would you design the sampling scheme in your study to collect water samples. Number 2, how would you integrate knowledge exchange as part of the project, so that you would educate the volunteers on water quality. Number 3, how would you evaluate and validate the quality of the data obtained by the volunteers.

Slide 22 – Section Break

Slide 23

This is a list of the references that have been used in the lesson and which can provide further information on the topics of the lesson.

Slide 24

For further resources, the link to a study using community science to investigate water quality is on the slide. Also, there are two links to two websites that have community science projects where you will be able to look at a range of community science projects and look at what they are aiming to achieve and how you yourself could be involved.

Slide 25

Thank you, for listening and I hope you enjoyed this lesson about community science and water quality.