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“Science learning in online communities of scientific investigations: evidence and suggestions”

Maria Aristeidou, Eileen Scanlon & Mike Sharples

Abstract: This study is looking at how citizens engage with scientific investigations and it comprises two citizen inquiry communities: ‘Inquiring Rock Hunters’ and ‘Weather-it’. The communities originated from the idea of having citizens act as scientists. Therefore, the citizens were allowed and supported to create and facilitate investigations in collaboration with experts and based on their experience of everyday-life science. The following science learning aspects were investigated: type of learning taking place within the community, inquiry behaviour and patterns, scientific vocabulary and self-reported knowledge. Reflection on the main findings led to essential design suggestions that aim to facilitate the understanding of inquiry activities as part of a complete scientific process; balance the enjoyable parts of the projects with gains in scientific literacy; improve transferrable skills; and involve experts in conveying quality science topic culture and learning.

This study examines the learning experience that members of citizen science participation communities gain through their involvement. A recent review of participation in citizen science projects indicates a need for further research into their educational value and experience (Edwards, 2014). Kloetzer et al. (2013) identifies three levels of learning in citizen science participation projects. The first level is related to the mechanics of the activities (activity learning) the second focuses on the project and the science behind it (on-topic learning) and the third is associated with the learning within the community (community learning).

Still, the organisation of citizen science projects shows that scientific goals in citizen science projects precede the learning goals and thus learning happens as a side-effect of the training toward the completion of the project targets. To address the opportunity to provide more explicit educational benefits, citizen inquiry communities have been developed that combine citizen science with inquiry-led learning. In such communities, citizens are supported to create and facilitate personally meaningful

investigations in collaboration with scientists and the online environment is structured to enable collaborative inquiry learning (Aristeidou, Scanlon & Sharples, 2013).

The focus of this work is around two citizen inquiry communities: 'Inquiring Rock Hunters' and 'Weather-it'. The communities were accommodated by the nQuire platform (Villasclara-Fernandez et al., 2013) and the nQuire-it toolkit (Herodotou, Villasclaras-Fernandez, & Sharples, 2014), software that allows users to initiate, manage, share and complete inquiry projects of their own interest.

This work investigates types of learning taking place within the two communities, in relation to inquiry behaviour and patterns, scientific vocabulary, and self-reported knowledge. The analysis of types of learning takes into account the framework by Kloetzer et al. (2013) around the three levels of learning in citizen participation communities. Content analysis looked at evidence of inquiry and vocabulary progress. Thematic analysis categorized responses from user surveys around aspects of self-reported knowledge.

The main findings are that members gained content knowledge around the scientific topic and its methods (e.g. identification, data annotation), broke down some misconceptions, got involved in inquiry through discussions and oppositions, and produced a more scientific community vocabulary. It has also been identified that in Inquiring Rock Hunters, where inquiry phases were highlighted to the users, members were more aware of the scientific process. On the other hand, in the more user-led Weather-it community, members found their participation more enjoyable. Evidence from both communities shows that a number of members were concerned about whether they were making valuable contributions.

Design recommendations that aim to improve learning experience in citizen science participation communities include:

- to facilitate learning through inquiry as part of a complete scientific process;
- to balance the enjoyable parts of the projects with gains in scientific literacy;
- to involve experts more in creating support groups in order to enhance members' confidence and convey quality science topic culture and learning;

- to facilitate the language culture with a tool that allows input of online glossary to particular investigations.

Reflection on the main findings led to the above design suggestions that aim to facilitate the learning experience of members in online communities of scientific investigations.

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