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EDITORIAL

Action Research

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Characteristics of Action Research

This is the second issue of the newly launched journal ARISE. In the first part of this editorial some light will be shed on the characteristics of Action Research and Educational Action Research which makes it attractive in the field of science education and beyond. In the second part the three contributions in this issue will be shortly characterized.

Action research is becoming increasingly known as an approach that encourages practitioners in science education and other fields to be in control of their own work and contexts. Today it makes a significant impact in many professional contexts, particularly in teacher professional education. Its influence is worldwide, and has spread to many areas where personal and professional learning is undertaken.

Action research as originally conceived by Lewin (1948) is oriented to problem-solving in social and organizational settings, and has a form that parallels Dewey's (1933) conception of learning from experience. Like any other social research, action research proceeds by exploring problems in a more or less systematic manner – by formulating key questions, planning and designing investigations, gathering, processing and analyzing data, interpreting the data and drawing conclusions, which hopefully provide valid answers to the key questions.

Challenges in science education and in the teaching profession through changes in society (e.g., output orientation, quality evaluation and development, climate change) have resulted in an increased demand for corresponding professional development and practice-based research.

Educational action research (EAR) applies the concepts and practices of action research to the context of (science) education, so most educational action researchers are teachers. As a genre of action research, EAR recognizes both the uncertainty around the nature and extent of action (that needs to be undertaken in complex situations) and the general precariousness of conceptions of value. Researchers therefore need to engage in ongoing reflection on their actions and understandings, to inform further planning, action and understanding. Through this cyclical process, educational action researchers produce contributions to both conceptual and practical knowledge of education.

Hence, in science education as in other contexts, competent, professional action in complex situations requires concomitant learning processes as a sine qua non. Inversely, professional learning requires the experience of acting in complex practical situations. Through this lens, professional action and professional learning coincide in one stream of action. As professional learning happens in practical situations, which in turn are seen to require reflection and further development, knowledge and skill development go hand in hand with practical situational development (Feldmann, Altrichter, Posch & Somekh, 2018). Townsend (2013) distinguishes the following three modes.

1st person research

Here a person reflects on a situation through careful thought about what has happened, and records their reflections through audio- or video-recording, diary, or some similar form. The goal is to understand a situation and the self. The person doing the reflection is the only action researcher, for instance, a reflective science teacher.

Practitioners' research

Practitioners investigate their own practice through reflective inquiry. They conduct their research independently, sometimes with outside support, and their goal is to develop their practice. In this case the practitioners are action researchers, for instance a group of science teachers who plan to improve their instruction and to share their learning materials.

Collaborative action research

External facilitators collaborate with a group of people who share a cause. Their goal is to solve a problem or to create innovations. The external facilitators (e.g., university educators) are the outside action researchers, and their partners in participative inquiry (e.g., community activists) are inside co-researchers.

The diversity of the goals and scope of these three modes seems to imply that formulating common criteria for the quality of action research is a complex endeavor. But a close look reveals there are sufficient commonalities to present a list of qualities that apply equally to all three. Based upon the work of Heron and Reason (2008) and others, Stern, Townsend, Rauch and Schuster (2014) provide four principles of action research as guidelines for educational action researchers:

1. Good action research pursues worthwhile practical purposes by trying to find solutions for authentic problems. It empowers the people concerned to acquire relevant knowledge and to share it with others, leading to actions that are embedded in a humanistic value system.

2. Good action research is collaborative / participatory by involving the people concerned into the research process and agreeing upon ethical rules for the collaboration.

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3. Good action research is responsive and developmental, by engaging in a continuous series of research-and-development cycles. It takes into consideration the different perspectives of various stakeholders in search of satisfactory solutions to problems.

4. Good action research connects theory and practice as praxis by balancing action and reflection (reflection can inspire or evaluate actions or uncover the motives behind them; action can prove or disprove theoretical assumptions), and generating theoretical knowledge, delivering problem solutions, and promoting practical improvements.

Moving forward with the second issue of ARISE

The first two papers in this issue are research papers and apply and reflect these criteria at least to certain extend. In the first paper "Innovating Undergraduate General Chemistry by Integrating Sustainability-related Socio-scientific Issues" Christian, Zowada, Ozcan Gulacar and Ingo Eilks reflect a process of innovation for the integration of sustainability-related socio-scientific issues into U.S. undergraduate general chemistry courses to make chemistry learning more meaningful and relevant to the learners. The innovation originated from teaching and learning materials developed in Germany. Digital learning environments were created on hydraulic fracturing and phosphate recovery, two hot socio-scientific issues, which were then transferred, adapted, and implemented in the USA. The paper reflects selected students' feedback and how this process initiated ongoing curriculum innovation.

In the second contribution Ahmad Basheer, Avi Hofstein, Muhamad Hugerat & Naji Kortam investigate the influence of the use of Project-Based Learning (PBL) on Arab sector middle-school students' attitudes and motivation towards biology in Israel. The study was conducted using a mixed method design, with quantitative as well as qualitative elements. The findings indicate that an intervention program consisting mainly of combining the teaching of biology with PBL resulted in both increased motivation among students and more positive attitudes towards biology. The results might help in the formulation of recommendations for applying the PBL in biology and perhaps in other subjects as well.

The third paper falls into the category of short communications raising relevant issues. Ingo Eilks writes about the role of publications in science education and the question of their impact and evaluation. Publications play a central role when it comes to evaluation and review in the academia. They are important in cases of promotion, tenure or distribution of resources. The variety of different formats correspond to all the varying fields and tasks of science education research, development, or teacher education. This communication intends to provoke discussion how to value and relate the different formats to avoid only valuing dissemination and implementation of science education outcomes by peer-reviewed, English language journals.

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