

# Interdisciplinary Science in Action Conference Abstracts



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**University of Cologne**

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## Key Note

# What mechanisms mediate environmentally induced health effects?

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### ABSTRACT

Ionising radiation is an environmental stressor that we know a great deal about. It is an inducer of mutations in genomic DNA and of the phenomenon of genomic instability. The same can be said about several other environmental stressors, air pollution, for example. The conditions most commonly associated with exposure to ionising radiation are cancers and circulatory disease: both exhibit mutations and genomic instability in the affected tissues. In general, the affected tissues of exposed individuals give no reliable indication (biomarker) of radiation causation. Neither is it clear whether the conditions are underlain by mutation or genomic instability. Nevertheless, in terms of research, prevention and disease treatment, understanding the underlying mechanisms is important.

In this lecture I will make the case for genomic instability, rather than mutation, (genetics) being the underlying cause of radiation and other environmentally induced diseases.

*Keywords:* ionising radiation, environmentally caused disease, mutation, genomic instability

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# Multiple approaches to promoting well-being for older adults living with HIV

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## ABSTRACT

The proportion of older adults among people with HIV (defined as ages 50 and over) in the United States is increasing. In 2014, 43% of all people with HIV were ages 50 and over and this number is projected to reach 50% by 2017. A portion of older adults with HIV were newly diagnosed in later life but the majority are long term survivors of HIV infection. One major goal of HIV clinical care is focused on optimizing virologic control through linking and retaining individuals in medical care and encouraging medication adherence to achieve viral suppression. This is part of the so-called HIV care continuum or HIV treatment cascade and is a major focal point of much HIV intervention research. However, studies suggest that older adults with HIV have better short and long term medication adherence rates compared to younger adults but worse mental health outcomes. While medication adherence and virologic control remain important health outcomes for older adults with HIV, there are compelling reasons to expand outcomes research to consider a more holistic view of health and well-being. One approach is to apply the positive aging framework and socioecological model. The positive aging framework de-emphasizes fatalistic views of aging with a physical illness by emphasizing the ability of individuals to tap into psychological resources to remain affirmative despite challenges and suggests that quality of life is an appropriate and important health outcome for older adults. The socioecological model considers the ways in which the environment and other domains external to the individual affect health outcomes and health behavior. Evidence will be presented to highlight the relevance of these frameworks to HIV research. For example, in narrative studies of older adults with HIV, participants engaged in a discourse shift by reframing HIV infection in positive and empowering ways. Participants also emphasized the importance of seeking a quality life by establishing a life purpose and engaging in meaningful work. In one study of a cohort of older adults with HIV (N=177), regression analyses showed that better self-reported health status was associated with having a greater sense of purpose in life ( $p<0.01$ ) but not viral load ( $p=0.55$ ) or CD4 count ( $p=0.49$ ). Interventions that have shown to improve quality of life and feelings of life purpose in general older adult populations will be discussed within the larger socioecological context with applicability to older adults with HIV.

*Keywords:* HIV/AIDS, older adults, positive aging, socioecological model

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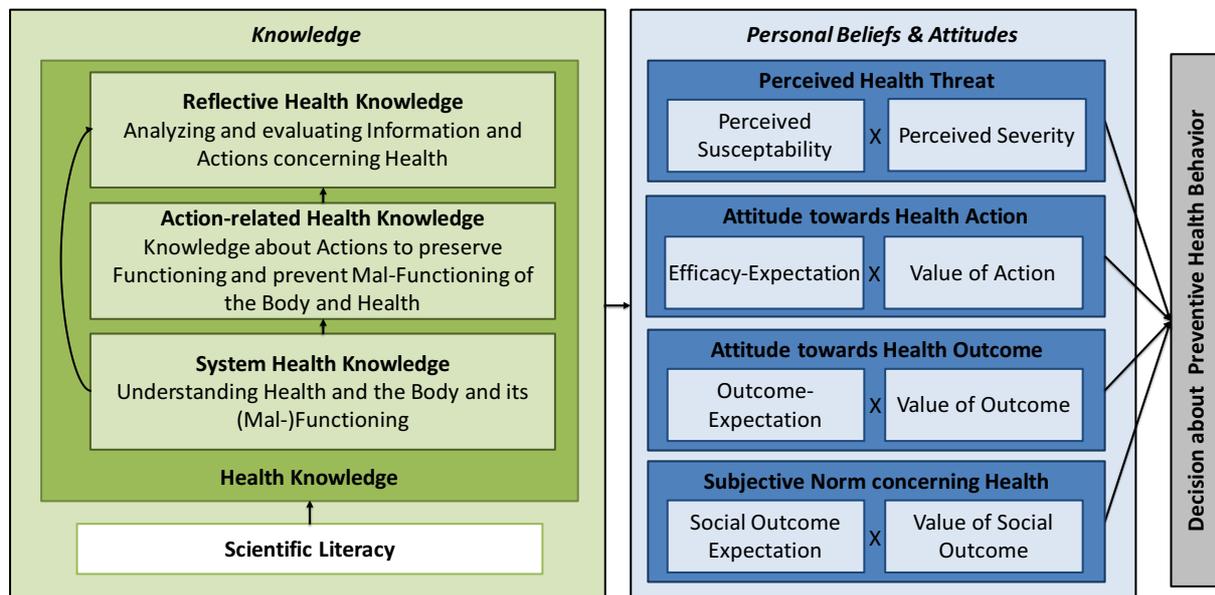
# Modelling Health Behaviour – Knowledge, Beliefs & Attitudes

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## ABSTRACT

There are several models to explain health behaviour. Most of them are prediction models and include several factors that can be used to predict Health Behaviour. These models are called continuous because a person can be “placed along a range that reflects the likelihood of action” (Schwarzer, 2008, p. 3). Such models for example are: the Social Cognitive Theory (Bandura 1977), the Health Action Process Approach (Schwarzer, 1992), the Health Belief Model (Rosenstock, 1974), the Theory of Planned Behavior (Ajzen, 1991), the Protection Motivation Theory (Rogers, 1983), the Frameworkmodel of Health Literacy (Zeyer & Odermatt, 2009) or the Intergrated Action Model (Rost et al., 2001). These models have several important factors in common, e.g. beliefs about of severity and vulnerability, expectancies about self-efficacy, the probability of the action leading to the desired outcome or some kind of incentives like for example values or evaluation-processes or cost-benefit considerations. But non of these models covers all the important factors, especially not in evaluation-value-pairs, and none of these models takes (health) knowledge into consideration. Hence, we propose a new model, which allows for investigations about the interrelations of these factors (Figure 1).



We expect the new model to be more powerful in explaining intentions for Health Behaviour, because of the combination of the different models as well as the inclusion of knowledge and specific knowledge types. The new model will be presented and discussed at the conference. In future, the model will be operationalized and tested empirically. If the model turns out to be powerful it can give hints at how to foster healthy behaviour by tailored interventions.

*Keywords:* health literacy, health education, attitudes, beliefs

Key Note

# Professional competence of teachers as a crucial factor for students' system thinking abilities in ecology

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### ABSTRACT

Consistent with this year's conference theme, "Interdisciplinary Science in Action," this presentation will be a critical reflection on the changing role of health promotion set within a broader public health framework. With the increasing globalization of public health concerns, there is a need to develop new and innovative solutions to increasing complex problems. These growing problems include global warming, environmental destruction and pollution, natural disasters, infectious and airborne disease epidemics, chronic disease, aging populations, and many other complex problems. Moving forward, it is unlikely that any single disciplinary approach will be able to resolve these issues. Rather, successful public health efforts will require flexible and adaptive inter- and trans-disciplinary teams that can synergistically combine their respective expertise toward new and innovative approaches. Moreover, it is likely that these collaborative teams will require expertise from diverse disciplines that range far beyond traditional public health disciplines. This presentation will offer examples and make recommendations for future efforts to combat emerging global public health concerns.

*Keywords:* Ecology, Professional competence, System thinking

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# Climate protection meets cognitive dissonance

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## ABSTRACT

Project "Klimabildung+" - Research and practical implementation in primary schools -

The project „Klimabildung+“ represents a real pedagogical challenge: Our mission is to educate primary school children on climate protection and empower them to take action without imposing too many constraints on their everyday life or frightening them.

“Should I buy a nice t-shirt which is produced under inhuman working conditions at the expense of the environment?”, “Should I avoid eating strawberries in winter?” or “How can I stop using plastic bags?”. Regarding those questions children are often drawn into an inner conflict. On the one hand, they want to protect the environment, on the other they are kept in their confirmed habits. Children cannot easily solve these mental conflicts on their own.

The new teaching units of NaturGut Ophoven deal with the inner dilemma which educators call „cognitive dissonance“. Children are stressed mentally when beliefs and values are inconsistent with one another. That concept goes back on Leon Festinger's theory from 1957 and focuses on how humans strive for internal consistency.

Project objective

The project wants to encourage children to behave climate-friendly and environmental-friendly and it wants to pinpoint options of how to decide in dilemma situations. The institute of Biology and its Didactics was responsible for the subject-didactic guidance. The program evaluation was conducted by “e-fect dialog evaluations consulting eG“. The evaluation aims to obtain well founded information on the effectiveness of the new teaching units, especially with regard to the experience of and coping with cognitive dissonance.

The revision of the five units was carried out on the basis of the evaluation results and the empirical values of the responsible project team.

Method: Teach climate protection in a different way!

All teaching units are organized in a practice oriented manner. Through dialogues pupils gain thematic input. An essential component of each program consists of the personal confrontation with a dilemma story which the pupils have to discuss. Thus, moral conflicts are evoked and finally solved in a way that children can easily deal with. The innovative method of dilemma stories provides the opportunity to deal with cognitive uncertainties concerning climate protection and to make children capable of acting.

*Keywords:* cognitive dissonance, inner dilemma, climate protection, teaching unit

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Oral Presentation

# Nature parks and science education

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## ABSTRACT

Numerous studies show a distanced relationship of children towards nature, which is expressed by the use of expressions such as “Naturentfremdung” (i.e. alienation from nature) (cf. Brämer 2014), human-nature-dichotomy (cf. Meske 2011), or nature deficit disorder (cf. Louv 2008). One possibility to face this problem could be to enhance direct/primary nature experiences (cf. Bögeholz 1999). For this science education could provide possibilities in the form of extracurricular learning units, in which lessons about nature would take place in nature. Furthermore, interest in and motivation for scientific education can thus be promoted.

Nature parks are suitable partners for this kind of scientific education because they provide knowledge of local circumstances, personnel support, and expertise for nature-orientated educational programs for children. Through their widespread distribution, nature parks are readily accessible for many schools.

In the context of a preliminary study the status quo of school related educational opportunities of nature parks in Germany was surveyed. The results indicate that the focus of the educational opportunities is on primary schools and on the subjects biology, geology, and history. The main study, a Delphi-Study, was carried out to expand the school-related educational opportunities of the nature parks and to elicit suitable topics for the scientific lessons in grade five and six (11-12 years old). The expert group consists of science teachers, didactic experts of science education, and educational managers of the nature parks. On both Delphi-rounds about 75 persons participated.

The results of the Delphi-Study indicate that certain topics are particularly suitable for science education in grade five and six. Within the field human-nature-economy these are the topics “human and landscape”, “sustainability, environment and nature conservation” and “agriculture”. In the context of the presentation the results shall be explained by the example of the production of apple juice from meadow orchards.

*Keywords:* nature parks, environment, science, outdoor education

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# Session 3: Environmental Science in Action

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Oral Presentation

## Children and nature awareness – Youth Report Nature 2016

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### ABSTRACT

Numerous studies in Europe and North America show a frightening nature alienation among young people. Prominent journalists like Richard Louv in the US (Louv, 2005) and George Monbiot in the UK (Monbiot, 2012) calls it "nature deficit disorder" or a "second environmental crisis: the removal of children from the natural world." Among others, they make digital media responsible for this.

In Germany, the "Youth Report Nature" (Jugendreport Natur) had been watching this development since 1997 (Braemer, 2006). For the current seventh report 2016, 1,253 students grades six and nine were interviewed in North Rhine-Westphalia.

The first results show striking results: In the past six years since the last report in 2010 elementary skills are further lost:

- Asked about the direction of the sunrise, only 35 percent of the students gave the appropriate response "East". In 2010, 59% were correct.
- In 2010 30% knew that hens only lay one egg per day. In 2016 just 19% got it right.

Could be one cause for those results, that young people have no more contact with nature? Not quite: Six out of ten students claimed having been in the forest at least once a month last summer. But not even one out of eight could name three fruits growing in or on the edge of the wood.

So the problem is not a lack of contact. More decisive seems to be that nature appears simply too boring, too uninteresting for our overstimulated young people.

*Keywords:* Youth Report Nature, Jugendreport Natur, nature alienation, contact with nature

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# How Can Environmental Health Impacts of Regional Climate Change be Minimized? A Focus on Vector-borne Diseases

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## ABSTRACT

Regional climate change plays an important role in the migration of animal and host species of human disease agents, including mosquitoes and ticks. Migration of vectors and host-species affect environmental changes in ways that make it very difficult to predict the outcome of the host-vector-parasitic interactions. This presentation reviews and highlights the relationship of regional climate change and vector-borne diseases.

Existing drivers of vector-borne diseases (e.g., seasonal weather variation, socio-economic status, vector control programs, environmental changes and drug resistance, climate change and variability) are highly likely to influence current vector-borne disease epidemiology. The effects are likely to be expressed in many ways, from short-term epidemics to long-term gradual changes in disease trends. For example, within the last several years, there have been noticeable climate change and increased incidences of West Nile Virus, Zika, Eastern Equine Encephalitis (EEE), and Lyme disease in the United States, particularly in Texas, Florida, Illinois, and California.

Texas will be used to provide specific examples of the potential to minimize human health impacts from vector-borne diseases. Data sources include the National Weather Service and the Centers for Disease Control and Prevention. We reviewed data for the last twenty years and correlated precipitation and temperature with the growth of specific vector populations. Maps and corresponding tables highlight areas subject to different types of weather events overlaid with case counts. Promoting understanding of regional climate change impacts at the local level is necessary to proactively plan for ways to minimize community health impacts by adapting and mitigating environmental conditions.

*Keywords:* Environmental Health, Climate Change, Vector-borne Disease, Climate Impact

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Oral Presentation

# Earth stewardship: science for action to sustain the human-earth system

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## ABSTRACT

Human activities affect Earth's life support systems so profoundly as to threaten many of the ecological services that are essential to society. A new science agenda is needed that integrates people with the rest of nature to help chart a more sustainable trajectory for the relationship between society and the biosphere. This presentation describes Earth Stewardship, an initiative of the Ecological Society of America to provide the scientific basis for actively shaping trajectories of social-ecological change to enhance ecosystem resilience and human well-being. Principles for moving toward these goals include simultaneous attention to multiple scales and issues; consideration of both ecological and socioeconomic consequences; alignment of incentives with stewardship behavior; strengthening peoples' connections to valued places; and using demographic transitions as new opportunities for stewardship. Past experience provides guidelines for fostering Earth Stewardship. Early attention to sustainable pathways before problems emerge generally provides more cost-effective solutions than attempting to remediate entrenched problems. Defining sustainable pathways by assessing tradeoffs among alternative options requires careful attention to fine-scale processes, interactions, and feedbacks and to larger-scale controls and constraints. Many opportunities occur locally, through development of practices that match the properties of resources with the needs of their users. Substantial challenges remain at larger scales, including maintaining the diversity, productive capacity, and resilience of nature, which are essential for long-term human welfare. The knowledge needed to inform stewardship requires an interdisciplinary science that draws on the observations, skills, and creativity of a wide range of natural and social scientists, practitioners, and civil society. New questions and solutions will emerge when these groups work together to formulate the issues, design the research, and co-produce the observations, knowledge, and concepts that form the basis for solutions. The goal of Earth Stewardship is not to protect nature from people; rather it is to protect nature for human welfare.

*Keywords:* Earth Stewardship, Sustainability, Ecosystem Services, Natural Capital

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# Session 4: Environmental Science in Action

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Key Note

## Neoliberal Economics and the Challenge of Protecting the Environment

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### ABSTRACT

The world is on a quest to achieve sustainable development if we are to believe those that sit at the controls of power in the international arena. Indeed the United Nations (UN) marked its 70th anniversary with the adoption of seventeen (17) Sustainable Development Goals (SDGs). Development as we understand it is first and foremost economic growth and social progress leading to a better life for the humans on this planet. So the mission is (should be) really one primarily of creating better economic and social conditions for all. However, the protection of the environment never featured in this equation. Alas we found out that this is easier said than done, as there is a price to be paid for this socio-economic progress. And some correctly understand that this price to be extracted by nature is one that threatens our very existence. Suddenly we see the necessity for a debate on sustainable development.

Some claim that the debate is now over and there is common agreement that sustainable development is the way to go. But is this agreement mere words without any substance? And who really have agreed to this? Are the actions required to realize this agreement being taken? Or are we preaching a new gospel while our old practices have become even more dangerous and subversive to the environmental integrity of the planet? Are people like the climate scientists that form part of the Intergovernmental Panel on Climate Change (IPCC), and others like Noam Chomsky, Chris Hedges and Gus Speth simply alarmists? Does not the findings of Oxfam as regards global economic inequality, and how it is reinforced and the consequences of the same; or those of the FAO concerning the growth of population and the consequent dramatic increase demand for food, water and energy point to anything except sustainability in the future? These are all really deadly serious questions that must be answered and answered now.

The Speaker, Dr. Richard A. Byron-Cox argues that the neoliberal economics presently ruling the world makes achieving the SDGs impossible. He is emphatic that these goals can only be realized through inter alia rejecting the present economic relations. He further argues that until protection of the environment is de facto elevated above the concerns of profit, there is going to be a catastrophic increase in environmental degradation, exposing the illusory nature of the plan to achieve the SDGs.

*Keywords:* environment, SDGs, neoliberal, economics

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Oral Presentation

# The interdisciplinary nature of environmental science research

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## ABSTRACT

Environmental Science encompasses a wide range of disciplines and as such is interdisciplinary by nature. Thus conducting research in the academic setting may require multiple approaches, different instrumentation, and institutional compliance. The complexity of this will be explored using our research program on water quality in regions with unconventional shale gas development as an example. The research involved field sampling, lab water analysis (e.g., ion chromatography, ICP-MS), data analysis, file reviews from different sources (e.g., PA Department of Environmental Protection and the Department of Conservation and Natural Resources), and GIS. Thus a combination of biology, chemistry, and geology as well as GIS technology was employed. Even though no personal data was collected, using a survey required Institutional Review Board approval. Lastly, a component of the project was community outreach that involved both private consultations with individual survey participants and public presentations to the broader community. An unanticipated consequence of the research was the legal ramifications in that the data became part of legal action (e.g., law suits were filed by some homeowners and the data was used as evidence). While the latter may not be a common outcome of most environmental research, the fact that it can be, requires strict attention to quality assurance and control including chain of custody, data validation, and proper record keeping.

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Oral Presentation

# Reimagining the “urban nature” concept: Ecological restoration through a new process of urbanization

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## ABSTRACT

The modern city is littered with contradiction. Humanity has developed a system of urbanization, which has the ability to create awe-inspiring structures and networks. Vast urban expanses stem from mountain-like centers of social and economic power where society's remarkable ingenuity and problem-solving adeptness are on full display. The contradiction lies on the fringe of these urban centers—spaces, which are commonly plagued by structural decay, poverty and pollution. The current process of urbanization is arguably the largest overall contributor to ecological degradation (mass extinctions, climate change, etc.). The proposed solutions revolve mainly around protection (as in legally protected areas). These solutions rest on a conception of nature as an object, in the etymological sense of the original *objectus*: something that is exterior and independent of humans, and which now should be protected from them so as to survive. We present, therefore a seemingly strange proposal: Urban Wilderness (URWI). By connecting two seemingly opposite realms, the concept challenges the premise of urbanization by reframing it around the *reinstitution* of nature. Our process is grounded on the main idea that humans are not separate from nature, but that we are *of* it. To put this idea into practice, we propose a process which democratically lends a voice to nature itself and is based around the following principles of Accessibility, Unity, Diversity and Cyclicity. We have produced a plan for how this process could begin to be put into motion locally, on a brownfield site in the *Ruhrgebiet*.

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# Session 5: Health Science in Action

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Key Note

## Health promotion: a vision for interdisciplinary science

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### ABSTRACT

The abilities needed to organize knowledge in a system context, to understand the functionality of systems, and to develop systemic problem solutions are fundamental for understanding ecology. Consequently, fostering system thinking is an important purpose of biology education. Little is known about the structure and the development of system thinking so far. Accordingly, the question arises which abilities characterize system thinking and how these abilities can be improved. Referring to the structure of system thinking, scholars assume that system thinking is characterized by at least two abilities: structural and procedural system thinking. Structural system thinking is the ability to identify a system's relevant elements and their interrelationships, altogether determining the system's framework. Procedural system thinking is the ability to understand the dynamic and time-related processes that emerge from the systems' structure, particularly occurring in within systems' elements and subsystems. Referring to the development of system thinking, it is reasonable to suggest that biology teachers and their professional competence are relevant factors for improving students' system thinking abilities. The presentation is guided by three aims: (1) to provide an example how to assess students' system thinking abilities in ecology, (2) to provide evidence about the empirical structure of system thinking, and (3) to identify teachers' professional competence as an influencing factor for students' system thinking abilities in ecology.

*Keywords:* Global Public Health, Health Promotion, Inter- and Trans-Disciplinary Solutions

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Oral Presentation

# An evaluation of interdisciplinary approaches to the use of simulation sites in health and human services workforce development

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## ABSTRACT

In southern California, the Public Child Welfare Training Academy (PCWTA) uses innovative multi-modality training and workforce development strategies to educate and train child welfare workers and leaders. The goal is to ensure child welfare practitioners can properly identify, assess and treat child abuse and neglect in order to positively impact health outcomes for children, families and communities. One new training modality, simulations, is still new in the field of child welfare but have been used successfully in other disciplines. Therefore, a review of the literature to explore how simulation sites are developed, implemented, and evaluated in other disciplines was warranted. A systematic review of peer-reviewed literature from 2011-2016 was conducted to assess how simulation sites are used in a variety of disciplines (social work, nursing, medicine, health education, environmental health, military and police training). The literature evaluated how simulations are being used to train, reinforce information, and facilitate overarching learning within each discipline. Of the total articles reviewed, components on training modalities, environmental characteristics, course content, and evaluation techniques were each abstracted. Following the abstraction process, a comparison of key components and evaluation methods were compared to the newly developed PCWTA simulation training.

Beginning in 2015, the PCWTA simulation site began running a fully operational apartment using actors to assist new social workers in practicing newly acquired skills in a safe, realistic environment. A specific focus centers on apply critical thinking to practice, and participation in a structured process of group learning. The simulation training modality promotes skill development and best practice by moving beyond basic lecture-based training and providing an opportunity for staff to integrate newly acquired knowledge into daily practice.

Based on qualitative and quantitative data collected from 2015-2016, we will review how the use of simulation in child welfare training has influenced social workers in their practice. Further, this presentation will summarize results from the systematic review, highlight the PCWTA simulation site training, and explore lessons learned. Particular focus on recommendations for interdisciplinary approaches in expansion of simulation training in health and human services will be discussed.

*Keywords:* Simulation training, Social Work, evaluation, review

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# Interdisciplinary science approaches in digital health research: an application of Twitter to examine e-cigarette sentiment in the United States

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## ABSTRACT

E-cigarette use has rapidly increased among youth and adults in the U.S. since nationally representative data were first collected on e-cigarettes in 2013. Researchers and professionals see increased e-cigarette use as a potential danger because: (a) carcinogens in e-cigarettes may pose a health threat to e-cigarette smokers, and (b) they may serve as a gateway drug to traditional cigarette use for non-smokers. Public health professionals also fear that e-cigarettes will re-normalize smoking behavior and the general public will no longer see smoking as a negative activity. Social media—interactive Web sites/applications enabling users to create, share, comment on, and modify content—represents a modality to assess such possible re-normalization. One type of social media, the microblog, consists of the sharing of short pieces of information to the public. One of the best known microblogs is Twitter, which averages 310 million (66 million U.S.) monthly active users who post content in the form of “tweets,” or messages of ≤140 characters. The current study examined conversations on Twitter related to use and perceptions of e-cigarettes in the U.S. We employed the Social Media Analytic and Research Testbed (SMART) dashboard, which was used to identify and download e-cigarette-related tweets. E-cigarette-related tweets were collected continuously using customized geo-targeted Twitter APIs. A total of 193,051 tweets were collected between October 2015 and February 2016. Of these tweets, 1,000 were randomly selected and manually coded for information regarding source, context, and message characteristics. Our findings reveal that, although more than half of tweets were positive, a sizeable portion were negative or neutral. We also found that, among those tweets mentioning a stigma of e-cigarettes, most confirmed that a stigma does exist. Conversely, among tweets mentioning the harmfulness of e-cigarettes, most denied that e-cigarettes are a health hazard. We also observed a noticeable absence of any official public health voice within the e-cigarette discourse on Twitter. Through the lens of the spiral of silence theory, results suggest that current efforts have left the public with ambiguity regarding potential dangers of e-cigarettes. Consequently, it is critical to communicate the public health stance on this issue to inform the public, and provide counterarguments to the positive sentiments presently dominating conversations about e-cigarettes on social media. The lack of awareness and need to voice a public health position on e-cigarettes represents a vital opportunity to continue winning gains for tobacco control and prevention efforts through health communication interventions targeting e-cigarettes.

*Keywords:* Cancer control and prevention, content analysis, electronic cigarettes, social media

Poster

# **An Approach: Building a virtual health databank about nutritional behaviour for three generations**

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## **ABSTRACT**

The aim of this project is to investigate whether teacher students will reflect more intensely on their health behaviour, expand their knowledge skills, and change their health-related attitudes by participating in an educational inquiry-based health intervention in Cologne, Germany.

An essential prerequisite of healthy living is health literacy that according to Sørensen et al. (2012, p.3) is linked to “literacy and entails peoples’ knowledge, motivation and competencies to access, understand, appraise, and apply health information...”. Low health literacy affects the population’s well-being adversely, e. g. it is linked to poorer health outcomes (Baker et al., 2007) as well as an increasing rate of diseases of civilisation (McGowan, 2005). According to Hsu et al. (2014), eHealth literacy, i. e. the ability to find health information from electronic resources, plays a major role among university students and influences their health behaviour (Stellefson et al., 2011). These findings suggest that universities should consider implementing electronic devices to help teacher students to improve their health literacy and after they graduate to influence health practices of their students in turn.

Contributing teacher students of this study will gather health information about the consumption of sugar-sweetened beverages and nutrition for three generations, e. g. adolescence, middle-aged, and elderly population, in order to build an interactive virtual health databank. Then, the collected data will be utilized by the participants themselves to scrutinize their findings and consider potential behavioural adjustments they could attempt so that the occurrence of adverse health conditions might be reduced. The impact of this study will be further evaluated and optimised by the practical methodology of design-based research (DBR) (Anderson and Shattuck, 2012). Potential survey questionnaires that focus on the participant’s health behaviour, knowledge and attitude towards nutrition and sugar-sweetened beverages will be employed.

*Keywords:* Health Literacy, Design-Based Research (DBR), virtual health databank, nutritional science

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Poster

# Learning about sustainability – rubber and inulin from dandelion

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## ABSTRACT

Dandelion is a widespread and well known but also underestimated plant. In recent research projects, which are - inter alia - carried out by the Fraunhofer-Institute for molecular biology and applied ecology, the university of Münster and the tire company Continental, *Taraxacum kok-saghyz*, a Russian species of dandelion, is investigated. The plant contains high-quality rubber (cis-1,4-polyisoprene) (cf. Schulze Gronover/Prüfer 2010) and the carbohydrate inulin (oligofructose with a degree of polymerisation  $n=2-60$ ), which is not only fibre but can also be used as a substitute for fat. Alongside this dual use, Russian dandelion is also particularly sustainable because it can be cultivated on marginal soils, which would not be suitable for food production. It can be transported for further processing in the local area with a low CO<sub>2</sub> emission and harvested twice a year. A tyre prototype which was presented in 2015 shall be ready for series production in five to ten years.

This topic is not only up-to-date but also economically important and of chemical and biological interest. It is going to be dealt with in a thesis which is concerned with curricular innovation research. This research methodology makes current and promising contents from economy, technology, the environment and life accessible for school (cf. Tausch, 2004, p. 18). For this purpose, new experimental approaches to subject contents are created as a first step. In a second step they are embedded in a didactic concept, in which learning sequences are developed and equipped with materials and media (in print as well as electronically). Subsequently, the newly developed components of the lessons are tested, evaluated with regard to the feasibility of the experiments and the suitability for school, and constantly optimised.

The poster presents experiments and suggestions for lessons which enable students to extract rubber and inulin from the roots of Russian dandelion, and analyse the products. In this process both old and modern analytical methods like IR-spectroscopy or thin-layer chromatography are used. Additionally, the role of sciences during World War II can be critically examined against the background of research on dandelions. This research was of strategic importance during the war and can be discussed in chemistry lessons which emphasise nature of sciences (cf. Heim 2003; Höttecke/Henke 2010).

*Keywords:* experiments, sustainability, dandelion, history

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Poster

# Explorative study about knowledge of species in the field of elementary education

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## ABSTRACT

Teaching children a respectful interaction with nature is an essential step towards the protection of the environment. In this sense the city of Cologne planned to introduce a “researchers’ box for small natural scientists” in day-care facilities to playfully teach children about fauna, flora and ecosystems. In one study we investigated the current state of the children’s understanding of nature, their experiences in and with nature, their species knowledge and their sense of responsibility towards nature before the introduction of the researchers’ box. Moreover, we examined which factors are positive or negative drivers for children’s knowledge and their sight of nature. With our findings we want to contribute to an environmental-oriented teaching in the kindergarten particularly taking into account specific factors which affect children’s learning of species and their relation with nature.

Questionings were conducted with children of the age of 4 and 5 in day-care facilities of the city of Cologne. The following factors were examined regarding their effect on the experience and knowledge of nature and species: 1) Sinus-Milieu representing the socio-demographic environment the children live in, 2) migration background, 3) age, 4) gender, and 5) children’s preference for nature. The children showed best knowledge in specifying small animals followed by flowers and birds. However, they hardly knew any trees. The migration background of the children had the main effect followed by the Sinus-Milieu and age. Gender and preference of being out in nature had no effect with respect to the analysed categories.

The study detected deficiencies concerning children’s’ understanding of nature, species knowledge and their sense of responsibility towards nature. On this basis, the application of the researchers’ box could be targeted specifically to promote those deficiencies.

A follow-up study was conducted one year after the introduction of the researchers’ box in the same day-care facilities to examine the gain of knowledge and sense of responsibility. Questioning were then conducted with 1) the same children as of the first study but who have by then worked with the researchers box for one year and 2) with children of the same age as in the first study (age 4 and 5) and who have also worked already with the box during one year. In general, the results showed that the work with the box and the involved communication and knowledge exchange about different topics had a positive effect on the learning gain of the children.

*Keywords:* children in the age of kindergarten, environmental education, species knowledge, species-appropriate behavior

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Poster

# Carbon dioxide and Ocean Acidification in school – The other side of climate change

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## ABSTRACT

Since the Industrial Revolution the carbon dioxide concentration (CO<sub>2</sub>) increased from 280 ppm (parts per million) to an average of 401 ppm in September 2016. The warming of the atmosphere and all connected consequences are just one aspect of the climate change because the man-made rise of the carbon dioxide concentration also causes acidification of the oceans. Calcifying organisms like mussels and corals are thus hindered in making lime or even die (cf. Bathmann and Passow, 2010). Not only the continued existence of reefs and the connected natural coastal protection is thereby endangered, but also the biodiversity of the organisms in the oceans – also fish and mammals as part of the food chain are part of this.

In the context of a research study the acidification of the oceans as a result of the climate change is made a subject of discussion and experimental exploration in primary school (grade 3/4; age 9-10) and in secondary education (grade 5-9; age 11-15). In a design experiment study the pupils learn about acidity and indicators which show changes of the pH value in liquids. Another part of the experiment consists of a demonstration how carbon dioxide passes from the air into the water and the changes of the pH value which are caused by this process. In a final experiment pupils experience what happens to a suspension of mussels when carbon dioxide is added.

The experiments were carried out with 32 groups of pupils, each consisting of three students of grade 3 to 9. The experiments were complemented by semi structured interviews. After the transcription the audio material was evaluated by means of the qualitative content analysis by Kuckartz (2016) with the help of the computer program MAXQDA. After reviewing the data, a system of categories was developed inductively. The system of categories includes the categories “impact on humans”, “impact on the atmosphere” and “impact on organisms” with several subcategories. Furthermore, some typical concepts of pupils concerning the acidification of oceans were detected so that recommendations to deal with the topic in science education can be given.

*Keywords:* ocean acidification, climate change, carbon dioxide, education

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