Authenticity in Biology Education

Benefits and Challenges

A selection of papers presented at the VIIIth conference of European Researchers in Didactics of Biology (ERIDOB)
13-17 July 2010
University of Minho, Braga, Portugal
Authenticity in Biology Education

Benefits and Challenges

Editors: Anat Yarden & Graça S. Carvalho
Publisher: CIEC, Universidade do Minho, Braga, Portugal
English editor: Camille Vainstein
Text layout: António Carlos Jesus
Cover photo: Anat Yarden
Cover design: Ziv Ariely, Department of Science Teaching, Weizmann Institute of Science, Rehovot, Israel

First published in 2011 by CIEC ("Centro de Investigação em Estudos da Criança") of the Institute of Education of Minho University, Braga, Portugal


All rights are reserved. However the articles can be freely reviewed, abstracted, reproduced or translated, in part or in whole, but not for sale or use in conjunction with commercial purposes. The views expressed or implied in this publication, unless otherwise noted, should not be interpreted as official positions of the CIEC.
Authenticity in Biology Education

Benefits and Challenges

A selection of papers presented at the VIII$^{th}$ conference of European Researchers in Didactics of Biology (ERIDOB)
13-17 July 2010, University of Minho, Braga, Portugal

Academic Committee

Dr. Anat Yarden (Secretary)
Weizmann Institute of Science, Rehovot, Israel

Dr. Dirk Jan Boerwinkel
University of Utrecht
The Netherlands

Dr. Margareta Ekborg
Umeå University, Sweden

Dr. Michael Reiss
University of London, UK

Dr. Vasso Zogza
University of Patras, Greece

Dr. Graça S. Carvalho
University of Minho, Braga
Portugal

Dr. Dirk Krüger
Freie Universität Berlin, Germany

Dr. Patricia Schneeberger
IUFM d’Aquitaine, Bordeaux, France

Local Organising Committee

Dr. Graça S. Carvalho

Dr. Zélia Anastácio
Dr. Cledir Santos

Dr. Rosa Branca Tracana
Dr. Sara Fernandes

António Carlos Jesus
Cláudia Ferreira

Emília Gonçalves
Carla Silva
Sponsors

FCT
Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

portoenorte TEM

Quality Tours
## Contents

**Preface** ix

**Section 1. Teaching biology using authentic learning environments** 1

1 **RESEARCH-BASED DESIGN OF A TEACHING SEQUENCE ON MARINE RESOURCE MANAGEMENT: HOW TO MANAGE CLASSROOM RESOURCES?** 3
   Beatriz Bravo-Torija and María Pilar Jiménez-Aleixandre

2 **NEW OPPORTUNITIES FOR AUTHENTICITY IN A WORLD OF CHANGING BIOLOGY** 15
   Francois Lombard

3 **SUPPORTING LEARNING OF HIGH-SCHOOL GENETICS USING AUTHENTIC RESEARCH PRACTICES: THE TEACHER’S ROLE** 27
   Hadas Gelbart and Anat Yarden

**Section 2. Various teaching strategies for the teaching of biology** 39

4 **TEACHERS’ AND STUDENTS’ USE OF CONCEPTS OF EVIDENCE IN JUDGING THE QUALITY OF AN INQUIRY** 41
   Saskia van der Jagt, Herman Schalk and Lisette van Rens

5 **DESIGN AND TEST OF OPEN-ENDED TASKS TO EVALUATE A THEORETICAL STRUCTURE OF MODEL COMPETENCE** 53
   Juliane Grünkorn, Annette Upmeier zu Belzen and Dirk Krüger

6 **USING A TEACHING-LEARNING SEQUENCE (TLS), BASED ON A PHYSICAL MODEL, TO DEVELOP STUDENTS’ UNDERSTANDING OF SELF-ASSEMBLY** 67
   Caroline Larsson, Gunnar Höst, Trevor Anderson, and Lena Tibell

7 **CONCEPTUALIZATION OF IN-SERVICE BIOLOGY TEACHERS’ PEDAGOGICAL CONTENT KNOWLEDGE (PCK) DURING A LONG-TERM PROFESSIONAL DEVELOPMENT PROGRAM** 79
   Ronit Rozenszajn and Anat Yarden

8 **STRATEGIES TO IMPROVE UNDERSTANDING AND USE OF HIV/AIDS CONCEPTS BY GRADE 11 BIOLOGY STUDENTS IN SOUTH AFRICA** 91
   Lindelani E. Mnguni, Mia Abrie and Liesel Ebersohn
Section 3. Teaching and learning biology in primary schools

9 CONCEPTUAL CHANGE IN PRIMARY SCHOOL CHILDREN FOLLOWING A MODERATE CONSTRUCTIVIST LESSON DEALING WITH DECOMPOSITION
Marcus Schrenk and Petra Baisch

10 THE FEASIBILITY OF SYSTEMS THINKING IN BIOLOGY EDUCATION
Kerst Boersma, Arend Jan Waarlo and Kees Klaassen

11 YOUNG CHILDREN’S REASONING ABOUT PHYSICAL family RESEMBLANCE AND ITS ORIGIN
Marida Ergazaki, Aspa Alexaki, Chrysa Papadopoulou and Marieleni Kalpakiori

12 ANALYSIS OF THE EFFICIENCY OF APPLYING PROBLEM-BASED LEARNING TO BIOLOGY INSTRUCTION OF ELEMENTARY SCHOOL ECOLOGY CURRICULUM
Jelena Stanisavljević, Dragan Đurić and Ljubiša Stanisavljević

13 ANIMAL SURVIVAL: LEARNING BY INQUIRY AND DESIGN IN PRIMARY SCIENCE EDUCATION
Marja van Graft, Martin Klein Tank and Sonja Verheijen

14 CHILDREN’S ATTITUDES TOWARDS ANIMALS: EVIDENCE FROM THE RODENTIA PROJECT
Maria João Fonseca, Nuno H. Franco, Francis Brosseron, Fernando Tavares, I. Anna S. Olsson and Júlio Borlido-Santos

Section 4. Reasoning and argumentation: The use of socio-scientific issues

15 DEVELOPING A PEDAGOGY OF RISK IN SOCIO-SCIENTIFIC ISSUES
Ralph Levinson, Phillip Kent, David Pratt, Ramesh Kapadia and Cristina Yogui

16 ARGUMENTATION STRATEGIES USED BY TEACHERS TO PROMOTE ARGUMENTATION SKILLS ABOUT A GENETICS SOCIOSCIENTIFIC ISSUE
Vaille Dawson and Grady Venville

17 ARGUMENTATION, NORMS AND NORMATIVITY: DISCOURSE ANALYSIS CONCERNING HUMAN EMBRYONIC STEM CELLS
Grégoire Molinatti
| 18 | THE REASONED ARGUMENTS OF A GROUP OF FUTURE BIOTECHNOLOGY TECHNICIANS ON A CONTROVERSIAL SOCIO-SCIENTIFIC ISSUE: HUMAN GENE THERAPY | 211 |
| Laurence Simonneaux and Habib Chouchane |
| 19 | SECTION 5. STUDENTS’ CONCEPTIONS AND CONCEPTUAL CHANGE: FOCUS ON EVOLUTION | 223 |
| | SITUATIONAL INTEREST IN EVOLUTIONARY TOPICS, CONTEXTS AND ACTIVITIES | 225 |
| Janina Jördens, Roman Asshoff, Harald Kullmann, Steven Tyrrell and Marcus Hammann |
| 20 | LEARNING PROGRESS IN EVOLUTION THEORY: CLIMBING A LADDER OR ROAMING A LANDSCAPE? | 237 |
| Jörg Zabel and Harald Gropengiesser |
| 21 | CROSS-CURRICULAR TEACHING OF ORIGIN OF LIFE: OPPORTUNITY OR THREAT? | 249 |
| Pam Hanley |
| 22 | TOWARDS AN INTERLANGUAGE OF TALKING SCIENCE—EXPLORING STUDENTS’ ARGUMENTATION IN RELATION TO AUTHENTIC LANGUAGE | 261 |
| Clas Olander and Åke Ingerman |
| 23 | EVOLUTION THEORY TEACHING AND LEARNING: STUDENTS’ CONCEPTUAL ECOLOGIES AND TEACHERS’ PERCEPTIONS | 271 |
| Penelope Papadopoulou, Panagiotis Stasinakis and Kyriacos Athanasiou |
| 24 | STUDENTS’ UNDERSTANDING OF EVIDENCE FOR EVOLUTION | 285 |
| Blanca Puig and María Pilar Jiménez-Aleixandre |
| 25 | THE ORIGINS OF HUMANKIND: A SURVEY OF SCHOOL TEXTBOOKS AND TEACHERS’ CONCEPTIONS IN 14 COUNTRIES | 295 |
| Marie-Pierre Quessada and Pierre Clément |
| 26 | BRAZILIAN TEACHERS’ CONCEPTIONS ABOUT CREATIONISM AND EVOLUTION | 309 |
| Ana Maria de Andrade Caldeira, Elaine S. Nicolini Nabuco de Araujo and Graça S. Carvalho |
**Section 6. Environmental education: Field-work**

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Authors</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>CONCEPTIONS AND ATTITUDES OF STUDENTS AND STAFF DURING THE IMPLEMENTATION OF SCHOOL AGENDA 21</td>
<td>Jean Simonneaux, Jean-Yves Lena, Benoît Jeunier, Raphaël Chalmeau and Marie Julien</td>
<td>325</td>
</tr>
<tr>
<td>28</td>
<td>“IT IS NOT THE CO2 ITSELF, IT’S THE IMBALANCE!” CONCEPTUAL RECONSTRUCTION OF THE CARBON CYCLE IN GLOBAL WARMING</td>
<td>Kai Niebert and Harald Gropengießer</td>
<td>339</td>
</tr>
<tr>
<td>29</td>
<td>DEVELOPMENT AND APPLICATION OF THE FINE FRAMEWORK FOR LEARNING IN NATURE</td>
<td>Orly Morag and Tali Tal</td>
<td>353</td>
</tr>
<tr>
<td>30</td>
<td>USING COMPANION MODELLING ON AUTHENTIC TERRITORIES IN THE TEACHING OF BIODIVERSITY</td>
<td>Michel Vidal and Laurence Simonneaux</td>
<td>367</td>
</tr>
<tr>
<td>31</td>
<td>RESIDENTIAL FIELDWORK: CONTRIBUTIONS TO SCHOOL SCIENCE FROM A FIVE-YEAR INITIATIVE FOR INNER-CITY STUDENTS IN THE UK</td>
<td>Ruth Amos and Michael Reiss</td>
<td>379</td>
</tr>
</tbody>
</table>
Preface

This volume consists of 31 original papers presented at the 8th Conference of European Researchers in Didactics of Biology (ERIDOB) held in July 2010 and hosted by the Research Centre CIEC of the Institute of Education, University of Minho, Portugal.

The theme of the conference was Authenticity in Biology Education: Benefits and Challenges. This theme emerged from discussions that took place at the ERIDOB 2008 meeting in Utrecht. During those discussions it became apparent that various ERIDOB members relate differently to the meaning of the term authenticity. Some expressed views that activities that are carried outside the classroom are authentic, while others thought that authentic activities should engage students in posing questions and designing their own paths to solve them. During the conference we re-explored the meaning of the concept of authenticity and discussed possible means to implement it in schools. The outcomes of those discussions can be appreciated in the ERIDOB 2010 special issue of the Journal of Biological Education that is devoted to the conference theme (Vol. 45 (3), September 2011) as well as in one of the sections of this volume (Section 1). The theme of authenticity blends wonderfully with many other topics that are of utmost interest to researchers in biology didactics, such as various teaching strategies for the teaching of biology (Section 2), teaching and learning biology in primary schools (Section 3), reasoning and argumentation: the use of controversial socio-scientific issues (Section 4), students’ conceptions and conceptual change: focus on evolution (Section 5), and environmental education: field work (Section 6). Altogether, we hope that this volume represents the current state of the art of research in the field of biology education.

Approximately 55 papers were submitted for consideration of publication in this volume, from amongst approximately 200 presentations at the ERIDOB 2010 conference. The ERIDOB Academic Committee, together with other members of the ERIDOB community, peer-reviewed all the papers and helped us put together the selected articles that appear in this volume. We are thankful to all the reviewers who invested significant time and effort in the review process. Our thanks go also to Camille Vainstein for improving the English and for copy-editing the papers, and to Antonio Carlos Jesus for his excellent work in type-setting this volume.

Anat Yarden

Graça S. Carvalho