

ISSN 0124 - 5481

# REVISTA DE EDUCACIÓN EN Ciencias

## Journal of Science Education

Vol. 6 N° 2, 2005



Science electronic portfolios p. 97

A new teaching mode in Physics p. 63

Science news: Cassini finds new Saturn moon p. 110



Investigación • Internet • Computadores

Métodos activos • Innovaciones • Creatividad

Desarrollo de capacidades



UN



**Director of the  
Journal**

**Yuri Orlik**

**Editorial Board**

**Alan Goodwin**

Education of Science

**Agustín Adúriz-Bravo**

Education of Science

**Luz C. Hernández**

Education of Science

**Charles Hollenbeck**

Education of Physics

**Yuri Orlik**

Education of Chemistry

This Journal is indexed and abstracted  
in Chemical Abstracts (CA), Educational  
Resources Information Center (ERIC),  
Educational Research Abstract Online  
(ERA) UK, (<http://www.tandf.co.uk/era>);

Contents Pages in Education, UK;

Latindex, México;

Yahoo!;

([www.yahoo.com/Education/Journals](http://www.yahoo.com/Education/Journals))

You can access the Journal On Line:

[www.colciencias.gov.co/rec](http://www.colciencias.gov.co/rec)

Subscribe to the Journal On Line

**Representantes de Revista:**

Argentina, Sonia Concart,

[sconcart@fiqus.unl.edu.ar](mailto:sconcart@fiqus.unl.edu.ar)

Uruguay, Marina Miguez,

[mmiguez@ing.edu.uy](mailto:mmiguez@ing.edu.uy)

USA, Charles Hollenbeck,

[CHollenbe@aol.com](mailto:CHollenbe@aol.com)

México, Susana Hernández,

[suelen@avantel.net](mailto:suelen@avantel.net)

**JOURNAL OF SCIENCE EDUCATION  
REVISTA DE EDUCACIÓN EN CIENCIAS**

**COMITÉ DE APOYO / COMMITTEE OF SUPPORT**

CONVENIO ANDRÉS BELLO  
ÁREA DE CIENCIA Y TECNOLOGÍA  
David Gómez Villasante

PONTIFICIA UNIVERSIDAD JAVERIANA  
FACULTAD DE CIENCIAS  
Ángela Umaña

ACADÉMIA COLOMBIANA DE CIENCIAS  
Moisés Wasserman

CENTRO DE INNOVACIONES EDUCATIVAS EN CIENCIAS  
Reconocido por COLCIENCIAS, categoría A, Colombia

UNIVERSIDAD DISTRITAL Francisco José de Caldas  
Carlos Javier Mosquera  
Facultad de Ciencias y Educación  
José Manuel Flores  
Adela Molina

UNIVERSIDAD ANTONIO NARIÑO  
María Falk de Losada

UNIVERSIDAD DE LA SALLE  
Fabio Gallego Arias

UNIVERSIDAD JORGE TADEO LOZANO  
Jaime Pinzón López  
Juan Manuel Caballero

UNIVERSIDAD PILOTO DE COLOMBIA  
José Alberto Alvarado  
Patricia Piedrahita  
Carlos Hernández Campo  
René Julio Castillo

LATVIAN UNIVERSITY OF AGRICULTURE  
Juris Skujans  
Baiba Briede  
Anda Zeidmane

UNIVERSITY OF GLASGOW / CENTRE OF SCIENCE EDUCATION  
Norman Reid

UNIVERSIDAD DE LA REPÚBLICA, Montevideo  
Unidad de Enseñanza, Facultad de Ingeniería

**COMITÉ DE CONSEJEROS / COMMITTEE OF ADVISERS**

Carlos Corredor, U. Javeriana, Colombia  
José Lozano, Academia Colombiana de Ciencias  
José Rolando Roldán, U. de los Andes, Colombia

Iliá Mikhailov, UIS, Colombia

Fidel Cárdenas, UPN, Colombia

Luis H. Blanco, U. Nacional, Colombia

José Toro, U. de los Andes, Colombia

Rómulo Gallego, UPN, Colombia

John Bradley, University of the Witwatersrand, S. África

Peter Towse, University of Leeds, UK

Carlos Furió, U. de Valencia, España

Peter Childs, University of Limerick, Ireland

José María Sánchez, U. de Alcalá, España

Alex Johnstone, University of Glasgow, UK

Orno De Jong, Utrecht University, The Netherlands

Malcolm Cleal-Hill, Manchester M. University, UK

Liberato Cardellini, University of Ancona, Italy

Ryszard M. Janiuk, U. Marie Curie-Skłodowska, Poland

Ram Lamba, University of Puerto Rico

Jenaro Guisasola, U. del País Vasco, España

Charly Ryan, King Alfred's College, UK

Zoltan Toth, University of Debrecen, Hungary

Wilson González-Espada, Arcansas Tech University, USA

Charles Hollenbeck, Chaffley Community College, USA

Valentín Gavidia, U. de Valencia, España

Mansoor Niaz, U. de Oriente, Venezuela

Sarantos Psicharis, Greek Pedagogical Institute, Greece

Marina Miguez, U. de la República, Uruguay

Moisés Camacho, University of Puerto Rico

Peter Schwarz, Kassel University, Germany

Michael Gagan, Open University, UK

Graciela Merino, U. Nacional de La Plata, Argentina

Muhammad Hageral, Arab Academy College for Education in Israel

Baiba Briede, Latvian University of Agriculture

Rosária Justi, Universidade Federal de Minas Gerais, Brasil

Stelios Piperakis, University of Thessaly, Greece

Ann Cartwright, ACS, USA

Nora Valefrías, U. Nacional de Córdoba, Argentina

Hans-J. Schmidt, University of Dortmund, Germany

Victor Miheev, Russian People Friendship University

Wenxiang Zhu, Beijing Normal University, PR China

Colin Bielby, Manchester M. University, UK

© Fundación Revista de Educación de las Ciencias

## COORDINADORA EDITORIAL

Luz C. Hernández

### Asistentes de edición

Cecilia Hernández  
Lilia Eslava de Aja  
Consuelo Vargas

### Asesor contable

Carmen Rosa Vizcaino

### Foto de carátula

<http://ciclops.org>

Dr. Carolyn Porco

Cassini Imaging Team (NASA)

Director/CICLOPS

### SPACE SCIENCE INSTITUTE

4750 Walnut Street | Suite 205  
Boulder, Colorado 80301, USA

### Diseño e impresión

Fundación Cultural Javeriana de  
Artes Gráficas -JAVEGRAF-

ISSN 0124-5481

**La Revista de Educación en  
Ciencias no se responsabiliza  
por las ideas emitidas por los  
autores.**

Los artículos de esta revista  
pueden ser reproducidos  
citando la fuente

### Bien excluido de IVA

Página WEB con  
la Revista Virtual:  
<http://www.colciencias.gov.co/rec>

### Address of the Journal:

Post Box (Apartado) 241241,  
Bogotá, Colombia

Phone/Fax (571) 211 80 69

E-mail: oen85@yahoo.com

## JOURNAL OF SCIENCE EDUCATION, vol. 6, N 2, 2005

### CONTENTS

WORLD YEAR OF PHYSICS 2005 .....	62
A NEW TEAM TEACHING MODE IN UNIVERSITY PHYSICS TEACHING Un nuevo modo de enseñanza en equipo de la física universitaria YANG JIANHUA, GONG YUNGUO, SUN LIMING, CHENG MINGFEI (PR China) .....	63
DIGGING INTO EARTH SCIENCE: ALTERNATIVE CONCEPTIONS HELD BY K-12 TEACHERS Excavando las ciencias de la tierra: ideas alternativas de profesores de K-12 DAHL J., ANDERSON S.W., LIABRIN J.C. (USA) .....	66
TABLAS DE YOUNG COMO HERRAMIENTA DOCENTE EN MATEMÁTICAS Teaching mathematics with Young tableau NOVA RAMÍREZ J.F. (Colombia) .....	68
DEVELOPING A NEW BIOLOGY COURSE FOR 16-19 YEAR-OLDS Desarrollando un nuevo curso de biología para estudiantes de 16-19 años REISS M.J. (UK) .....	72
PRESENTATION AND CONSOLIDATION OF PHYSICAL AND CHEMICAL CHANGES OF SUBSTANCES THROUGH PUPILS' ACTIVE WORK Presentación y consolidación de cambios físicos y químicos de sustancias a través del trabajo activo de los estudiantes KOROLIA J., JOVIC G., STELJIC B., MANDIC L. (Serbia) .....	76
EDUCATION IN THE FRAMEWORK OF SYSTEM THEORY La educación con énfasis en teoría de sistemas PSYCHARIS S., DAFLIOS A., PSYCHARI A., CHRYSAFADI K. (Greece, UK) .....	79
QUANTITATIVE MICROSCALE CHEMISTRY EXPERIMENTATION (VOLUMETRY, GRAVIMETRY, ELECTROCHEMISTRY, THERMOCHEMISTRY) Experimentos cuantitativos en química de microescala (volumetría, gravimetría, electroquímica, termoquímica) NING-HUAI ZHOU (China), HABELTZ-TRÖTZ W. (Germany), GIESLER D. (Germany), EL-MARSAFY M.K. (Egypt), SCHWABZ P. (Germany), HUGERAT M. (Israel), NAJDOSKI M. (Macedonia) .....	84
ESTRATEGIA DE MOTIVACIÓN PARA EL APRENDIZAJE DE LOS ESTUDIANTES DE EDUCACIÓN SUPERIOR Motivation strategy for learning in higher education students LÓPEZ-LARA T., HERNÁNDEZ-ZARAGOZA J.B., PÉREZ-REA M.L. (México) .....	88
STUDENTS' WORLDVIEWS AND SCHOOL SCIENCE: A DAVID AND GOLIATH CONFRONTATION? Las perspectivas del estudiante y la ciencia escolar: ¿una confrontación entre David y Goliath? MEDINA JEREZ W. (USA) .....	90
LA INFLUENCIA DE LAS SECUENCIAS DIDÁCTICAS SOBRE LA CONSTRUCCIÓN DE NARRACIONES DE LOS ESTUDIANTES DE ENSEÑANZA BÁSICA: UN EJEMPLO SOBRE EL TEMA ELECTRICIDAD Effect of didactic sequences on narrative constructions about electricity of primary school students KOGA D., INFANTE-MALACITAS M.E., AMARIS J.M., SANTOS S. (Brasil) .....	93
SCIENCE ELECTRONIC PORTFOLIOS. DEVELOPING AND VALIDATING THE SCORING RUBRIC Desarrollando y validando los portafolios electrónicos en la enseñanza de las ciencias FORAWI S., XIN LIANG (USA) .....	97
INTERDISCIPLINARY INSTRUCTIONAL APPROACH TO THE THEME "AIR, WATER, SOIL AND FOOD POLLUTION AND ITS PREVENTION" Enfoque interdisciplinario para enseñanza del tema "Contaminaciones de aire, agua, tierra y comida y sus prevenciones" ŠKOVIC D., BOŠKOVIC D. (Serbia) .....	100
THE CRITICAL CONDITION OF ENVIRONMENTAL EDUCATION IN ARGENTINA: THE NEED FOR CONCEPTUAL AND METHODOLOGICAL INNOVATIONS AND NEW EDUCATIONAL POLICIES Estado crítico de la educación ambiental en Argentina: la necesidad de innovaciones conceptuales y metodológicas y nuevas políticas educativas MIGNARDI E., REVEL-CHION A. (Argentina) .....	103
DETERMINING R/S CONFIGURATIONS OF A CHIRAL MOLECULE WITH THE NEWMAN PROJECTION FORMULA Determinación de R/S configuraciones de una molécula quiral con la fórmula de proyección de Newman YZZET KURBANOGLU N., MENZER A. (Turkey) .....	106
WHAT CONTENT FOR BIOLOGICAL EDUCATION IS IN SUB-SAHARAN AFRICA TODAY? ¿Cuál es el contenido moderno de la educación biológica en África Subsahariana? GUEYE B. (Senegal) .....	107
SPECIAL SECTION: MICROSCALE SCIENCE. Sección especial: ciencia en microescala .....	109
MICROSCALE EXPERIMENTS DEALING WITH THE HISTORY OF MAKING FIRE Science News / Novedades de las ciencias Cassini finds new Saturn moon that makes waves .....	110
La Olimpiada Iberoamericana de Matemáticas vuelve a celebrarse en Colombia .....	111
Reseñas de libros / Book reviews .....	112
Direcciones de páginas Web .....	114
Formato de suscripción .....	114
Index 2005 .....	115
Carta al director .....	117

**What content for biological education is in Sub-saharan Africa today?**  
**¿Cuál es el contenido moderno de la educación biológica en África Subsahariana?**

**BABACAR GUEYE**

Ecole normale supérieure, Dakar, Senegal - [babacargueye@nomade.fr](mailto:babacargueye@nomade.fr)

## **Abstract**

*Nowadays Sub-saharan Africa is characterized by a lot of problems linked to under-development:*

*-Every year the size of the population grows significantly while food resources are not adequate; there is a large food deficit (malnutrition, famine, etc.).*

*-A major environmental deterioration, which is due to deforestation, resulting in a reduction of the biodiversity, desertification, and uncontrolled urbanization.*

*-Several endemic diseases like AIDS and malaria are causes of death in most of the countries. There is a low life expectancy (45-50 years) and a high maternal and infant mortality. To face this situation and set a sustainable rate of development, Sub-saharan Africa has to struggle first, against the high illiteracy of most of the population by defining new educational curricula in schools in areas related to knowledge, skills for the resolution of practical problems, and positive attitudes. In facing such a challenge, biological education has a large part to play in order to give to every citizen the minimum of scientific knowledge which is necessary to live in harmony with*

his environment. In Sub-saharan Africa, the task will sometimes be very difficult because of certain traditional values like excision, polygamy, etc. Our hope is that, in the years to come, the didactics of biology will develop new approaches and strategies which will overcome most of these obstacles and move towards a better understanding of the objectives of biological education.

**Key words:** Africa, education, biology, culture, society.

### Resumen

Hoy día África subsahariana se caracteriza por muchos problemas unidos al bajo desarrollo: - Todos los años el tamaño de la población crece significativamente mientras los recursos de comida no son adecuados; hay un déficit grande de comida (la desnutrición, el hambre, etc.). - Una deterioración medioambiental mayor, debida a la deforestación mientras produce una reducción de la biodiversidad, desertificación, y urbanización desenfrenada. - Varias enfermedades endémicas como el sida y la malaria son causas de muerte en la mayoría de los países. Hay una esperanza de vida baja (45-50 años) y una mortalidad maternal e infantil alta. Para enfrentar esta situación y poner una proporción sustentable de desarrollo, África subsahariana tiene que esforzarse primero, contra el alto analfabetismo de la mayoría de la población definiendo los nuevos planes de estudios educativos en las escuelas en las áreas relacionadas con el conocimiento, habilidades para la resolución de problemas prácticos, y las actitudes positivas. Enfrentando tal desafío, la educación biológica tiene una parte grande para jugar, para dar a cada ciudadano el mínimo conocimiento científico necesario para vivir en armonía con su ambiente. En África subsahariana, la tarea es a veces muy difícil debido a ciertos valores tradicionales como la excisión, poligamia, etc. Nuestra esperanza es que en el futuro la didáctica de la biología desarrollará nuevos enfoques y estrategias para superar la mayoría de estos obstáculos y promover la mejor comprensión de la educación biológica.

**Palabras clave:** África, educación, biología, cultura, sociedad.

### INTRODUCTION

The population of Africa today is about 720 million inhabitants, while it was only 350 million in 1970. Estimates are that it will reach 1.4 billion in 2025.

In Senegal, the fecundity index is still 6 children per woman. In many areas, children are still regarded as a source of income, of social prestige that may be a support to parents in their old age.

For obvious reasons, this demographic explosion is a source of many problems whose solutions indeed require scientific education inside and outside the school framework.

The main environmental concerns are:

- desertification
- deforestation
- soil exhaustion
- various forms of pollution
- continued loss of biodiversity
- overexploitation of non renewable resources
- quick and uncontrolled urbanization

On a health level, there is a high morbidity rate related to the many endemic diseases (aids, malaria etc), as well as the constant problems of *undernourishment* and malnutrition.

All this is made worse by very profound scientific and technical illiteracy, which explains the hard work awaiting the educators in charge of reinforcing the population's skills, so as to improve their living conditions permanently.

It is often said that all the poverty and underdevelopment problems cannot be solved by education, which is probably a fact, but it is also true that without education these problems will not be solved (OBANYA, 1999).

In this education, the place of biology will be more and more important in relation to the present situation of Sub-saharan Africa.

After a historical survey of the scientific curriculum in Sub-saharan Africa, I will describe the present socio-economic context, before identifying its implications for education in general and for the biology curriculum in particular.

### A historical survey of the scientific curriculum in Sub-saharan Africa

In most Sub-saharan African countries, curricula have for a long time been a mere blueprint of the former colonizer's system, be it Belgian, French or English.

However, since the 1960's, UNESCO has repeatedly organized inter-

national conferences, so as to lead the various countries to adapt curricula to their socio-economic and also local cultural realities.

What is curriculum? In the literature of educational sciences (WHITFIELD, R.C., 1971; African Curriculum Organization, 1979; MILLAR R. and OSBORNE, J.F. (Eds.); 1998), the curriculum concept may be understood in two ways:

For some, the curriculum is the set of contents (knowledge, know-how, behavior) that must be taught, whereas for the others it encompasses both the contents and the whole educational process, including teachers' education, teaching materials, methods and learning activities.

In the framework of this paper, I intend to limit myself to the first definition.

**What about UNESCO interventions?** The first conference on the curriculum in Sub-saharan Africa was held in 1961 at Addis Ababa in Ethiopia. One of its recommendations was the implementation of the scientific and technical syllabus meant to favor the training of highly qualified researchers, engineers and teachers.

In 1964, at the conference in Abidjan (Ivory Coast), emphasis was laid on the unavoidable readaptation of educational contents in order to ensure the emergence of individuals having a balanced relationship with their environment.

For the first time during that conference, it was requested that natural sciences be included in the curriculum. The subsequent conferences: NAIROBI (1968), LAGOS (1976) and HARARE (1982) made it a point to stress that educating does not mean only transmitting knowledge, but also preparing learners to live as adult citizens and the different members of society to take responsibility for their way of living.

Recommendations were made to set up the intensive teaching of science from the primary level, so as to give the learner the basics that will enable him/her to fit into a world that is more and more dominated by science and technology.

At the Dakar conference in 1991, UNESCO, while restating the absolute necessity of a scientific education at all levels (primary, secondary and upper), recommended a thorough adaptation of the teaching of sciences and techniques to the learners' environment, so as to provide them with the ability to contribute significantly to the development of society.

UNESCO had simply restated the unavoidable linkage between the curriculum and the needs of society where teaching takes place.

Today in Sub-saharan Africa, it is therefore high time to develop teaching that fits the natural and socio-economic conditions of the continent, specifically in biology, whose teaching contents need to be contextualised.

### **Implications of the present Sub-saharan African context for the biology curriculum**

In spite of the efforts and progress exerted in the field of education for many years, problems still exist and are getting worse in some countries.

The solution of the above-mentioned problems is not only dependent on a wider dissemination of biological science and technology, but also on a re-adaptation of the educational content to the local contexts. Too often in the current programs, the atom and the molecule hide the living being and his environment, which condition indeed contributes to directing teaching away from the learner's everyday concerns.

The teacher who opens up his learner's eyes as to the main concerns prevailing in the country, and provides him with the knowledge and practical experience which allow him to take part in its development, is better than his colleague who sticks to a genuinely academic approach.

Now, the point is not only to take into consideration the knowledge at stake, but also to think over and analyze objects, instruments, problems, tasks, contexts and social roles, and the variance between school and practical activities taken as references (MARTINAND, 2001).

In the particular case of biology, it the suggestion can be made to teach the different ecosystems of Sub-saharan Africa, man's role in the degradation of his environment, and man's responsibilities in the transmission of diseases, and to lead populations to have a positive attitude toward the environment and to get rid of some negative values.

To reach such teaching objectives geared to solving problems in Sub-saharan Africa, I believe that problems should be tackled both at school and outside school. Therefore, the biology curriculum should be reshuffled into three major domains: population and environment; population and health; population and food production.

In each of the domains, crucial problems may be identified, which, depending on the country and period, appear in different forms.

The following table recapitulates some problems and their corresponding aspects in each of the domains.

For each problem, general objectives may be defined that will be reached

<b>DOMAINS</b>	<b>PROBLEMS</b>	<b>ASPECTS</b>
Population and Environment	Resource Management and Exploitation	<ul style="list-style-type: none"> <li>• resources types and state</li> <li>• forms of exploitation and consumption</li> <li>• production modes</li> <li>• waste management</li> </ul>
	Environmental Degradation	<ul style="list-style-type: none"> <li>• deforestation</li> <li>• pollution</li> <li>• soil degradation</li> <li>• biodiversity loss</li> </ul>
Population and Food Production	<ul style="list-style-type: none"> <li>• Undernourishment</li> <li>• Malnutrition</li> </ul>	<ul style="list-style-type: none"> <li>• kitchen gardening</li> <li>• horticulture</li> <li>• arboriculture</li> <li>• stock farming</li> </ul>
Population and Health	<ul style="list-style-type: none"> <li>• Diseases</li> <li>• Reproductive Health</li> <li>• High Birth Rate</li> <li>• High Morbidity</li> </ul>	<ul style="list-style-type: none"> <li>• prevention</li> <li>• family planning</li> <li>• contraception</li> <li>• hygiene</li> </ul>

in a longer or shorter term.

For example, in the environmental domain, the child must from a very early age be sensitized through observation and experience. The following objectives may be targeted:

### ***Cognitive objectives***

- understanding the natural laws that regulate ecosystems in Sub-saharan Africa
- knowing the preservation methods for natural resources
- knowing the recycling methods for wastes

### ***Affective objectives***

- being aware of the danger of overexploitation of resources
- having a positive attitude toward the preservation and improvement of environment

### ***Know-how***

- acquiring the technical means necessary for the protection and restoration of environment quality

For example, in order to help learners acquire gardening and arboricultural practices, gardens and orchards are irreplaceable learning contexts where concrete information and practice can be developed around the following questions: How can plants be multiplied? How do we plant them? How do we fight against parasites? How should we prune? How should we graft? How should we fertilize soils? How should we preserve



crops and harvests? Etc.

## CONCLUSIONS

To make such objectives attainable, not only should present programs and teaching methods prevailing in the formal education sector be revised, but mainly a realistic policy should be set up using the local languages as much as possible, so as to reach the illiterate public at large, focusing on opinion leaders who are the traditional chiefs and religious leaders, who may serve as valuable relays in any popular undertaking in Africa. Contemporary society requires a populace who have a better understanding of science, enabling them to engage in a critical dialogue about the political and moral dilemmas posed by science (American Association for the Advancement of Science, 1989; MILLAR and OSBORNE, 1998).

Besides, owing to the complex nature of the problems, biology will have to tackle them through an interdisciplinary approach in coordination with social and family economics and geography, to arrive at a systematic method that may ensure the setting up of relevant and lasting solutions.

However, in the specific framework of Sub-saharan Africa some traditions and established social values can block the contextualized teaching of biology. These are age old, deeply rooted practices such as excision, polygamy and early marriages, that should also be included in the new curricula in Sub-saharan Africa

## BIBLIOGRAPHY

- African Curriculum Organization. Basic Training Course in Systematic Curriculum Development. Nairobi, ACO, KIE; GTZ, 1979.
- American Association for the Advancement of Science. *Project 2061 Science for Americans*. Washington, DC: AAAS, 1989.
- GUEYE, B. *Enjeux et difficultés d'une culture scientifique et technique en milieu rural africain* in Actes des xxivèmes journées internationales, Chamonix 18-22 mars 2002.
- MARTINAND, J.L., *Pratiques de référence et problématique de la référence curriculaire* in A. Terisse (éd). *Didactique des disciplines; les références au savoir*; Bruxelles, De Boeck, 2001.
- MILLAR, R. & OSBORNE, J.F. (Eds.). *Beyond 2000: Science Education for the Future*. London: King's College, 1998.
- OBANYA, P., *The Dilemma of Education in Africa*, Dakar, Unesco/Breda, 1999.
- OKIGBO, B.N., *Role of research and related activities in adaptation and improvement of science teaching in support of education and national development*. Journal of science teachers association of Nigeria, Ibadan, 16 [3], 18-30, 1978.
- SCHAEFER, G. & KATTMAN, U. *A New Type of Biology Curriculum*. Journal of Biological Education, London, 10 [5], 242-248, 1976.
- Science education program for Africa (1978). Handbook for teachers of science, Accra, Ghana, Sepa publication.
- WHITFIELD, R.C., *Discipline of the Curriculum*. London, McGraw-Hill, 1971.

Received: 11.06.2004 / Approved: 27.04.2005