Estonian Higher Education Accreditation Centre

Evaluation of Research in the Science Didactics Division at the University of Tartu

Institute evaluated

University of Tartu
Faculty of Biology and Geography
Institute of Molecular and Cell Biology
Science Didactics Division

Evaluation dates:
May 9-16, 2004

Expert team:

Prof. Leif Kirsebom (Chairman)
Uppsala University
Dept. of Cell & Molecular Biology
Biomedical Center, Box 596
SE-751 24 Uppsala
Sweden
E-mail: Leif.Kirsebom@icm.uu.se

Prof. Anders Virtanen
Dept. of Cell and Molecular Biology
Uppsala University
BOX 596
SE-751 24 Uppsala
Sweden
E-mail: anders.virtanen@icm.uu.se

Prof. Michael Elliott
Director
Institute of Estuarine & Coastal Studies,
& Department of Biological Sciences
University of Hull
Hull HU6 7RX,
UK
E-mail: Mike.Elliott@hull.ac.uk

Prof. Varpu Eloranta
Dept. of Teacher Education
University of Turku
Koskenniemenkatu 4
FIN-20500 Turku
Finland
E-mail: varpu.eloranta@utu.fi

General observations during the evaluation of all programs at Tartu University and Tallin pedagogical University

During the course of the visit the team has become of aware of several general issues, which cut across both universities, the faculties visited and the facilities observed. These can be separated into issues of personal health and wellbeing, the overall structure of the curricula and the evaluation process.

Personal health and wellbeing

- Health and Safety. We are aware of the national health care system in Estonia but there appears to be no health and safety insurance for either staff members or students within the University. Given the potentially hazardous conditions encountered in the laboratory and while doing fieldwork, the University system should strongly consider providing that insurance. This is of particular relevance and concern because of the increasing international mobility of staff and student.
- Facilities for students and staff with special needs. It was noted that many buildings are poorly equipped for students/staff with physical disabilities and other special needs. By providing these facilities the Universities will encourage wider participation in higher education and research.
- Harassment and discrimination. During our visits we became aware of that there are no plans or procedures to handle issues related to *e.g.* ethnical discrimination, sexual harassment and gender issues. This is of particular importance for universities given their hierarchical structure for example the student teacher relationship.
- Pastoral support for students. It was noted during the visits that whereas students have good academic support, pastoral support within the immediate unit or faculty was usually absent. The students therefore rely on support from a centrally-based student psychologist or friends. With increasing student numbers we foresee the need for an increased and more developed pastoral support for the students.

Overall structure of the curricula

- Preponderance of small courses. In all curricula that we have evaluated, it is apparent that the material is delivered using a large number of small credit-rated courses. We consider that this does not encourage a synthesis across or between topics and disciplines nor does it encourage teaching by groups of staff again preventing integration of subjects as well as assessment across topic borders. The team considers that the absence of a holistic teaching approach is not effective with respect to education and teaching and definitely not cost effective. A move to larger and more uniform module size will be a more effective and efficient use of teaching time and resources and it will allow greater ease of mobility between programs.
- Preparation of transition to the 3+2 system. The team was impressed by the fact that Estonia has already started to adapt to the new Bologna 3+2 system in their higher education. However, we became aware of an often negative attitude towards the introduction of the new 3+2 system. In many cases this has already been communicated to the students. The units and faculties are encouraged to use this transition as an opportunity to improve and revise their curricula in order to maintain a high standard of education.

The evaluation process

- The team saw some examples of good practice in quality assurance and preparation of the SER. However, this was not uniform across all units. There is a strong requirement that all units adhere to a standard format and follow the sequence of headings given by the "Abbreviated Checklist for Evaluation Experts". It is of note that that checklist is in accordance with the "Standard Higher Education". Moreover, it is not necessary for all units to prepare an SER that contains information on the higher education of Estonia and on the history and structure/organization of their University. A single document covering the latter is sufficient.

Part I
General Overview

At the request of the Estonian Higher Education Accreditation Centre, Tallinn (EHEAC), the evaluation team (hereafter named the "Team") visited an Institute of Molecular and Cell Biology in Estonia, carrying out research activities in the Science Didactics Division. The evaluation team comprised of Prof. Leif Kirsebom and prof. Anders Virtanen (Uppsala University), prof. Varpu Eloranta (University of Turku) and prof. Michael Elliott (University of Hull). The institution to be evaluated was:
University of Tartu (UT)
Faculty of Biology and Geography,
Institute of Molecular and Cell Biology, Science Didactics Division *(Head: PhD Tago Sarapuu)*

The Team was provided in advance with a self-assessment report from the institution, prepared by the members of their research groupings.

After a brief orientation meeting at EHEAC, the Team visited the institution over one day. At these meetings staff members of the various Chairs presented their work. During these presentations as well as during the subsequent discussions additional information about the research activities was provided. This included additional documents such as copies of published papers.

Approach to the evaluation
The Team was asked to:
1. Judge the activities of research and development in the units evaluated and the research topics implemented by them to ensure the governmental funding for internationally recognised research and development.
2. Identify deficiencies in the activities of research and development unit.
3. Give recommendations on the development concerning research and development and research areas to the state of Estonia.

The Team received the following materials: A working schedule, principles and criteria for evaluation of the research units, evaluation guidelines for the ranking of research units, and a self-evaluation report created by the Department.

On a first evaluation point, the ***quality of the research activities*** was considered. This assessment is largely based on the records of scientific publications.

Excellent	***The majority of the submitted works are at a high international level and virtually all others at a good international level.***
Excellent to good	*At least one third of the submitted works are at a high international level and many others at a good international level, these together comprise a clear majority.*
Good	***The majority of the submitted works are at least at a good international level and virtually all others at a fair international level***
Good to satisfactory	*At least one third of the submitted works are at a good international level and many others at a fair international level, these together comprise a clear majority*
Satisfactory	***The majority of the submitted works are at least at a fair international level***
Satisfactory to unsatisfactory	*A minority of the submitted works are at a fair international level*
Unsatisfactory	***None, or virtually none, of the submitted works are at a fair international level***

Regarding the grading of the research activities, the Team was instructed by the EHEAC to reserve the term **excellent** for groups, which were found to be among the best 10% of the European groups in the corresponding field. Similarly, the term **excellent to good** should be used if the evaluated group was found to be among the best 25 % of corresponding European groups. The full scale comprised 7 levels, in addition to the highest ones the grades are **good, good to satisfactory, satisfactory, satisfactory to unsatisfactory,** and **unsatisfactory.**

Secondly, the ***over-all capability*** of a research unit was evaluated based on a the combined assessment of the following criteria (each graded in three levels):

	Grade 0	Grade 1	Grade 2
Originality/novelty of past and ongoing research activity	descriptive, no novelty	some novelty/originality	original/novel
The strategy and perspective of research	no or bad strategy, no or unclear perspective for further research	fair strategy and perspective for further research	clear strategy and very perspective for further research
Multidisciplinarity and relevance for other research areas	no multidisciplinarity, no relevant for other research areas	some multidisciplinarity, some relevance	good multidisciplinarity, good relevance for other research areas
The competence of research groups and their capability for development	low competence	there is competence, but no young postgraduate and postdoctoral students	there is competence and postgraduate and postdoctoral students
National and international co-operation	no particular national and international co-operation	some national/international co-operation	good or tight national/international co-operation
Success in applying for funds and grants	no particular success	fair success	applying successfully for grants and funds

Excellent - 12-10 (total grade), **Good** - 9-7 (total grade), **Satisfactory** - 6-4 (total grade) and **Unsatisfactory** - 3-0 (total grade).

As the result of this assessment one of the four grades **excellent, good, satisfactory** or **unsatisfactory** was given for the group.

Thirdly, the ***implementation opportunities*** for the research results and their importance for the Estonian society were commented.

Finally, on a fourth evaluation point ***the critical comments and recommendations*** were asked to given by the expert team.

Part II
General Comments

Strengths and weaknesses of the unit
Strengths – There are two competent PI, these have strong and frequent international collaborations, they are open-minded and willing to take ideas from wide sources; the PI's have created good group dynamics and a coherent research group. A third PI, a visiting professor, is internationally recognized within this field.

Weaknesses - This is a small group and there is some concern whether there is a critical mass. There is uncertainty regarding security for one of the PI, and uncertainty regarding the position of the unit within the system. It is recommended that this lack of stability should be solved in the near future, for example by the creation of a Chair covering the research group in order to provide stability and greater security.

Adequacy of resources
The unit has a good space and they make good use of it. They are well equipped with regard to IT facilities and support, literature and software. However, their survival depends on receiving external money and thus their planning can only be in the short term. The unit's rooms are spread in three locations throughout the building thus possibly making the unit less efficient than otherwise would be the case.

Productivity
The unit has been very productive despite the above limitations. The second PI has not been in position as an independent researcher for very long but is now getting established. An increased critical mass will increase productivity.

Publication record
The unit has a high output per staff although this relies heavily on the three PI. There is a large number of papers, chapters, conference proceedings and electronic media. However, there appears to be relatively few peer-refereed papers in internationally high quality journals. It is recommended that the unit reviews its publishing strategy, for example, more conference papers could be submitted to journals.

This group appears to be widely known through their collaborations with other European groups and those in the US. This is demonstrated through the award of grants, conference organization and participation, and international collaboration. It is of note that they are invited to participate in EU-FP6 projects.

International/National rating
The reduction in grade points in the rating of overall capability was the result of:

a) an evidence of lowered originality
b) the need for a better long-term strategy for future research.
c) the absence of young post-doctoral students.

It is emphasized that the research performed is essential on a national (Estonian) basis and that although the group is ranked "Good to Satifactory" on an international scale, this ranking would be much higher on a national scale.

Part III
Evaluation of institution

Science Didactics Division *(Head: PhD Tago Sarapuu)*

The main fields of scientific work of the Division include:
Philosophy of science education, scientific and technological literacy, relevance of science education, socio-scientific reasoning, inquiry approach, cognitive development, teacher ownership, children's learning, ICT-supported individual and collaborative inquiry, cognitive aspects of ICT-based visualized learning process in science, operationalization of learning objects in ICT based learning.

The staff of the department

No	Name	Position	Degree	Area	Gender	Year of Birth
1.	Tago Sarapuu	Docent, Head of Division	PhD	Science and technology education	male	1956
2.	Miia Rannikmäe	Senior Researcher	PhD	Science education	female	1951
3.	Jack Holbrook	Visiting Professor	PhD	Science education	male	1941
4.	Urmas Kokassaar	Lecturer	MSc	Biology didactics	male	1963
5.	Illar Leuhin	Lecturer	MSc	Biology didactics	male	1961
6.	Ülle Liiber	Lecturer	MSc	Geography didactics	female	1957
7.	Kai Pata	Researcher	MSc	Science and technology education	female	1969
8.	Margus Pedaste	Researcher	MSc	Science and technology education	male	1976
9.	Anne Laius	Researcher	MSc	Science education	female	1956
10.	Margot Keres	Senior Assistant	BSc	Technical Assistant	female	1970
11.	Vjatšeslav Dmitrijev	Methodologist	BSc	ICT Specialist	male	1977
12.	Arle Puusepp	Assistant	BSc	ICT Specialist	male	1981

1. The workgroup of educational technology (directed by docent T. Sarapuu)

Basic funding

DEVELOPMENT OF SCIENTIFIC AND TECHNOLOGICAL LITERACY AMONG STUDENTS (1998–2002). Principal investigator: Tago Sarapuu, Ph.D. Researches: Miia Rannikmäe PhD, Jack Holbrook PhD, Kai Pata MSc, Margus Pedaste MSc, Kristjan Adojaan MSc. Funding 1180000 EEK

DESIGNING VISUALIZED LEARNING PROCESS THROUGH EDUCATIONAL TECHNOLOGY (2003-2007), Printsipal investigator: Tago Sarapuu, Ph.D. Researchers: Kai Pata MSc, Margus Pedaste MSc, Kristjan Adojaan MSc, Kaire Jõgi MSc, Eve Kikas PhD. Funding: 2003 416,000 EEK, 2004 468,000 EEK

Grants from Estonian Science Foundation

THE EFFECTIVENESS OF USAGE OF INSTRUCTIONAL WEB SITES ON THE FORMATION OF STUDENTS' NORMATIVE COMPETENCIES IN ENVIRONMENTAL EDUCATION. ESF Grant No 4473 (2000-2003). Principal investigator: **T. Sarapuu**. Researchers: Kai Pata, Margus Pedaste, Kristjan Adojaan, Kaire Jõgi. Funding 234,000 EEK

OPTIMIZING THE ARCHITECTURE OF LEARNING OBJECTS AND ENVIRONMENTS IN RESPECT OF LEARNING THEORIES. ESF Grant No 5996 (2004-2007). Principal investigator: Tago Sarapuu. Researchers: Kai Pata, Margus Pedaste, Kristjan Adojaan, Kaire Jõgi. Funding 1994 – 110,000 EEK

Grants from abroad

DISSEMINATION, IMPLEMENTATION AND EVALUATION OF EDUCATIONAL MATERIALS ON BIOTECHNOLOGY – AN EIBE (European Initiative for Biotechnology Education) project EU DG XII project PL970304 (1998-2001). Principal investigator: T.Sarapuu. Investigators: K. Pata, M. Pedaste, K. Kübar, K. Adojaan. Funding 313,000 EEK.

THE SCIENCE TEACHER EDUCATION DEVELOPMENT IN EUROPE (STEDE) – a thematic network of the ERASMUS program of EU. EU ERASMUS Program No 10082-CP-1-(99)2000 (2000-2002) principal investigator T.Sarapuu. Investigators: K. Pata, T. Laane, A. Puusepp. Funding 35,000 EEK.

BIOLOGY, HEALTH AND ENVIRONMENTAL EDUCATION FOR BETTER CITIZENSHIP (BIOHEAD-CITIZEN) FP6-CITIZENS-2. Specific targeted research project related to the theme Science and Society (2004-2006) – the contract will be signed by the Commission in May 2004. Principal investigator T.Sarapuu. Investigators: K. Pata, M. Pedaste, K. Adojaan

Evaluation of Research Activities

The Team of evaluators judged the overall quality of the research to be ***Good to Satisfactory***.

Evaluation of Overall Capability

The Team of evaluators judged the overall capability of the research to be ***Good***

	Grade
Originality/novelty of past and ongoing research activity	**1**
The strategy and perspective of research	**1**
Multidisciplinarity and relevance for other research areas	**1**
The competence of research groups and their capability for development	**1**
National and international co-operation	**2**
Success in applying for funds and grants	**2**

The implementation opportunities for the research results and their importance for Estonian society

Given the increased European perspective especially in the fields of pedagogy and didactics, then there is a large opportunity for increased research, in this area. This group is well placed to capitalize on these developments.

There are very large possibilities and a high relevance for this research in an Estonian capacity and context.

2. The workgroup of the philosophy of science education (directed by the senior researcher M. Rannikmäe)

Basic funding

TOWARDS A PHILOSOPHY OF RELEVANCE IN SCIENCE EDUCATION AND FACTORS INFLUENCING ITS OPERATIONALISATION (2003–2007). Principal investigator: Miia Rannikmäe, Ph.D. Researchers: Jack Holbrook PhD, Priit Reiska Dr. sc. Paed, Anne Laius M.Sc. Funding 2003 576,000 EEK, 2004 648,000 EEK.

Grants from Estonian Science Foundation

DETERMINING STUDENT'S CONCEPTUAL AND ATTITUDICAL LEARNING BASED ON THE USE OF SOCIALLY DERIVED, STUDENT PARTICIPATORY SCIENCE TEACHING MATERIALS ESF Grant No 3247 (1998-2000). Principal investigator Miia Rannikmäe. Investigators: A. Kikkas, H. Otsnik, A. Parts Funding 124,500 EEK

EVALUATING THE STL PHILOSOPHY: THE INFLUENCE OF CONSTRUCTIVIST INSTRUCTION ON STUDENTS' LEARNING OF SOCIO-SCIENTIFIC REASONING IN SCIENCE. ESF Grant No 5663 (2003-2005). Principal investigator: Miia Rannikmäe 2003 – 85,000 EEK; 2004 – 85,000 EEK

Grants from abroad

THE RELEVANCE OF SCIENCE EDUCATION (ROSE). Principal M.Rannikmäe. Investigator: M.Tepo Financial support from the University of Oslo (2003-2004) 30,000 EEK

SYSTEMATIC PROFESSIONAL DEVELOPMENT THROUGH SCIENCE TEACHER EDUCATION MODULES – SySTEM. COMMENIUS project (2002-2004). Principal: M.rannikmäe 395,000 EEK. Principal: M.Rannikmäe. Investigators: J. Holbrook, A. Laius, M. Teppo.

Grants from the Estonian Ministry of Education.

WHAT IS HAPPENING IN SCHOOLS — DOES IMPLEMENTATION MATCH INTENTION? A MESSAGE FOR FUTURE CURRICULUM DEVELOPMENT. Principal: J.Holbrook. Investigators: E. Tarro, K. Kask.Financial support (2001-2002) 35,000 EEK

DEVELOPMENT OF STUDENT-CENTRED TEACHING SKILL AND ITS INFLUENCE ON STUDENTS' COGNITIVE AND AFFECTIVE DOMAINS. Principal: M.Rannikmäe. Investigator: A.Laius. Financial support (2001-2002) 30,000 EEK

STANDARDS FOR PRACTICAL WORK IN SCIENCE SUBJECTS. Principal:M.Rannikmäe. Investigators: K. Kask, A. Laius. Financial support (2001-2002) 45,000 EEK

Evaluation of Research Activities
The Team of evaluators judged the overall quality of the research to be ***Good to Satisfactory***

Evaluation of Overall Capability
The Team of evaluators judged the overall capabality of the research to be ***Good***

	Grade
Originality/novelty of past and ongoing research activity	**1**
The strategy and perspective of research	**1**
Multidisciplinarity and relevance for other research areas	**2**
The competence of research groups and their capability for development	**1**
National and international co-operation	**2**
Success in applying for funds and grants	**2**

The implementation opportunities for the research results and their importance for Estonian society

Given the increased European perspective especially in the fields of pedagogy and didactics, then there is a large opportunity for increased research in this area. This group is well placed to capitalize on these developments.

There are very large possibilities and a high relevance for this research in an Estonian capacity and context.

Recommendations

Overall Recommendation for Workgroups:

1) to target their publications in international, peer-refereed journals;

2) to increase the coherence and critical mass of the group;

3) to ensure that the technological research is relevant internationally, not only nationally;

Part IV
Conclusions and Recommendations

* It is concluded that this unit is doing good and relevant research and that its capability should be encouraged and developed in a national and international sphere.

* The group is prolific in presenting its work at conferences and in publishing in proceedings and workshop papers. However, it is recommended that they target their publications more effectively towards various peer-reviewed international journals.

* The unit has a good group dynamics and uses its space and facilities efficiently. However, it is recommended that in order to improve their research, the unit's offices should be relocated to provide more coherent space facilities.

* The unit is led by two competent and well-regarded senior researchers. It is recommended that in order to give greater stability and standing to the group, the University should consider creating a Chair as the unit.

* It is hoped and expected that this unit will expand, given the requirement nationally and internationally for its research. In this case, it is recommended that the unit should be separated from IMCB and become a self-standing unit within the faculty of Biology and Geography. This will allow it to work across the Institutes of that Faculty, as well working with other faculties, especially the other science faculties.

Tallinn, 15.05. 2004

The evaluating team:

Leif Kirsebom_____

Michael Elliott_____

Anders Virtanen_____

Varpu Eloranta_____