"INFORMATION AND COMMUNICATION SYSTEMS" CURRICULUM DEVELOPMENT PROJECT

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Abstract

The objectives of the European project presented in the paper are to develop an interdisciplinary curriculum in information and communication technologies for a joint MSc degree and to investigate experimentally the effect of performance-centred platform for the design, composition and reuse of open course learning materials. The partners are from six universities from five European countries — Bulgaria, France, Ireland, Spain and the Netherlands. The work is at the stage of implementation of the MSc degree. Each partner has developed two courses in the area of its expertise. Students have finished the first four courses and in March are starting the second module of two courses.

"Information and Communication Systems" (ICS) Curriculum Development Project

IPSS is one of the most advanced concepts in the domain of the educational e-learning initiatives. This project is based on the positive results and experiences within the European projects — four empirical studies applying strong experimental design proved that IPSS has useful contribution to the classical higher education in the domain of engineering. In the project we have new things:

- ICS is a complete programme at master degree level at the point of intersection between information technology and telecommunications.

- It is the first attempt of applying and testing the idea of IPSS for the support of a complete curriculum for a hybrid specialty, connecting technology with science.

- As a new technology, performance-centred system will move the education process to the learning embedded in the contexts of the "supposed workplace."

In this project discovery inductive strategy is implemented in an intelligent computer-assisted instruction (related most to problem-solving) with courses in ICS to serve as a base for the analysis the possibilities of developed Performance-centered learning management system DIPSEIL to support a complete multi-lingual curriculum, with shared educational resources, and leading to a recognized joint degree at European level.

Performance-centered e-Learning Course

DIPSEIL, as a typical performance support system, is an integrated electronic environment, which is available via Internet and is structured to provide individualized online access to the full range of information, guidance, advice, data, images, tools and software to permit the user to perform a task with a minimum of support and intervention by others. DIPSEIL has two specific characteristics:

1. The learning content is based on learning tasks. Performance tasks aim preliminary at specified learning outcomes.

2. There will be no lectures, practicals or final examination. Students only perform the learning tasks throughout the semester and collect credits for each learning tasks they perform adequately. They receive a final mark at the end of the semester based on the collected credits.

The ICS curriculum consists of several modules which represent a theme. The ICS Master curriculum (1.5 years) will contain the following themes:

<u>Semester 1</u>
- Telecommunication systems
- Realtime and Industrial Communications
- Internet Technology
- Advanced electronics for information and communication technologies

<u>Semester 2</u>
- Satellite and Mobile Communications
- Multi Media

- Two of electives:
  - Power-supply Equipment
  - Optical Fiber Cmmunication Systems
  - VHDL and synthesis
  - Microelectronics and Nanolectronics

For each task a set of learning objectives and performance standards are defined. The *learning objectives* provide a description of what the student will learn by performing the learning task (Bransford, Slowinski, Vye, & Mosborg, 2008; Colins, Joseph, & Bielaczyc, 2004).

Each learning task consists of the following elements:
- Introduction
- Learning objectives of the learning task
- Description of the learning task
- Resources (obligatory and elective)

The performance support system for learning is provided in the following elements
- Instructions how to perform the task (PSS)
- Task-specific training (PPS)
- Expert advice about the task (PPS)

Description of the Learning Task
The learning tasks are described, explaining to the students what is expected of them.

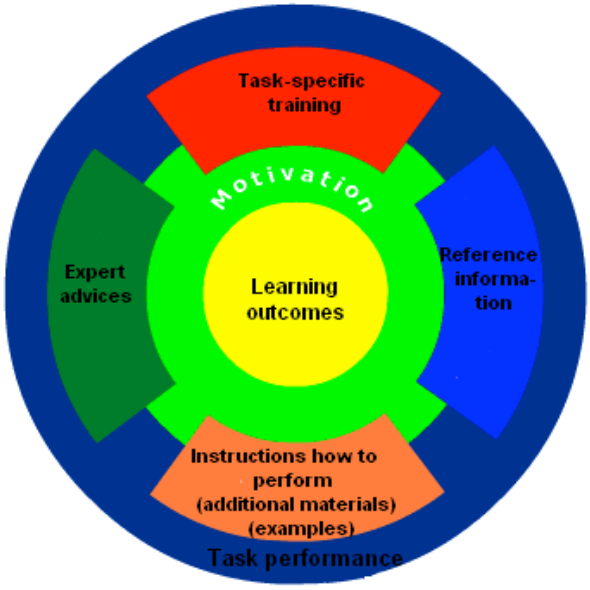
Resources (Obligatory and Elective)
Task relevant resources support students by making immediately available information, which they either have to study or use just in time to perform the task. The reference section allows the student to be better prepared for a given task because it is always available to the student and provides the theory behind the task it supports both forehand and just in time.

Instructions How to Perform the Task (PSS)
Worked-out solutions to problems using key task concepts. Additional materials and examples.

Task-Specific Training (PPS)
Task-specific training reduces preliminary training by helping the user to learn while performing the task. This type of training is learner controlled because the learners ask for help when they need it to perform a task, and the help gives them the specific information that they request.

Expert Advice about the Task (PPS)
If the student encounters a problem he can consult an expert for advice. Expert advices part contains specific advice on performing tasks. The advice is usually provided by an expert system.

Figure 1: Schematic overview of learning task structure



Examples

Figure 2: Task-specific training for Module 2 Task 3, presented in ppt format. One screen from the presentation.

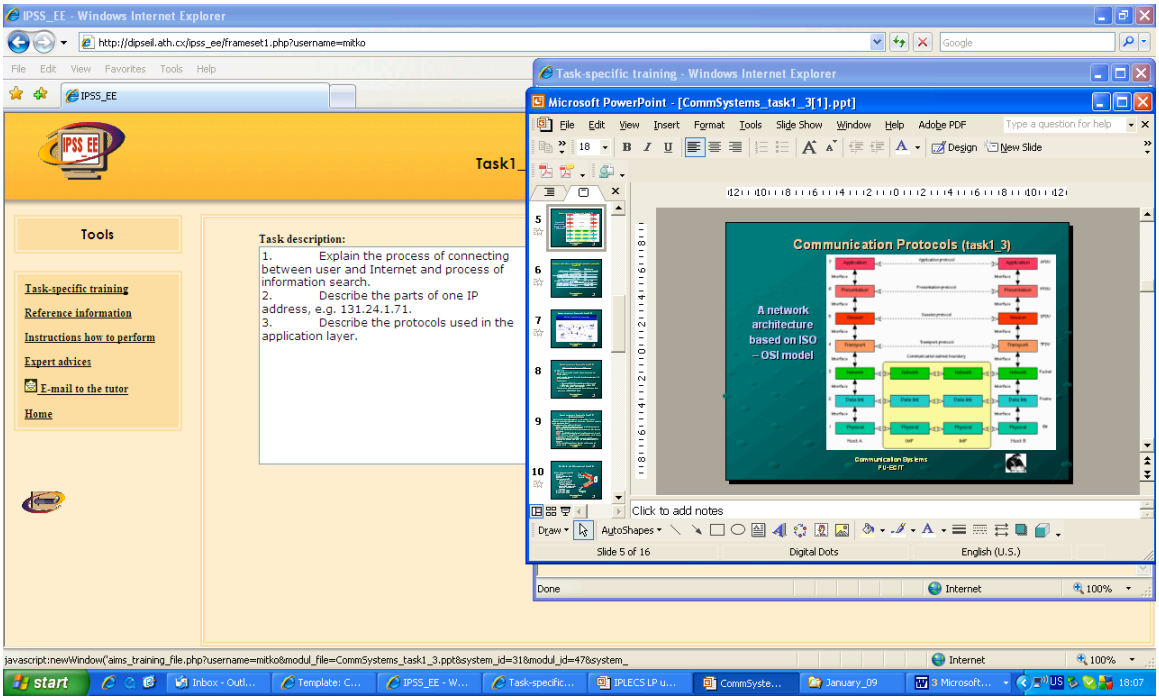


Figure 3: Reference information

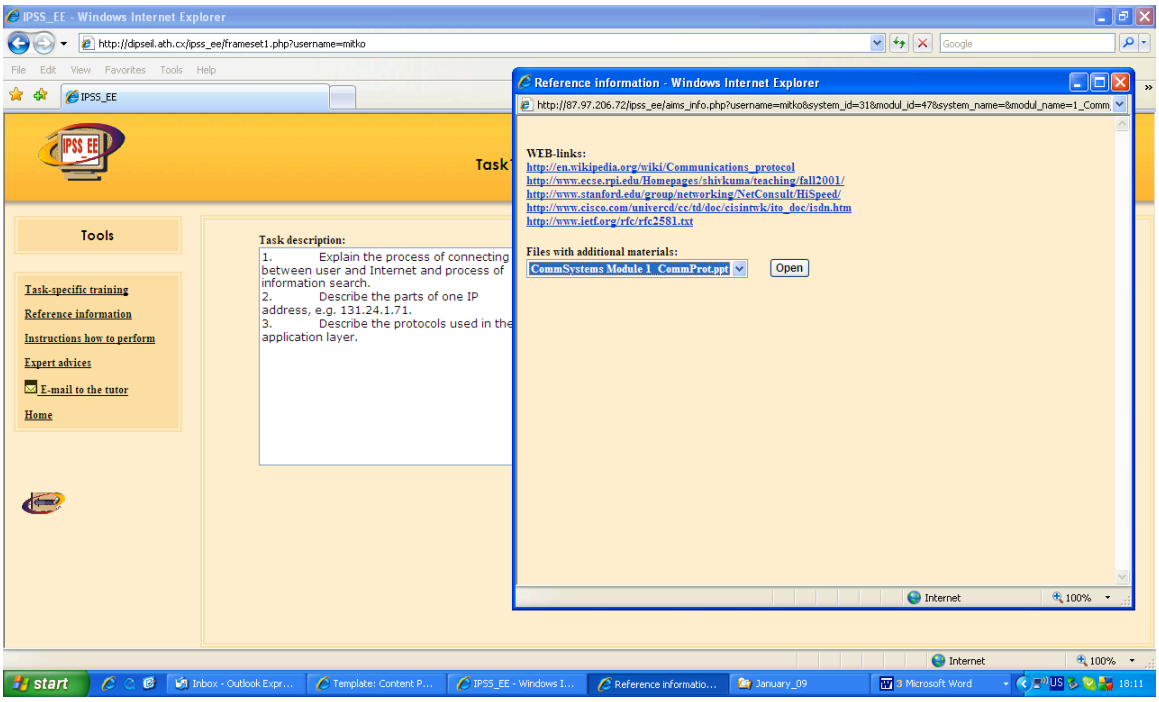


Figure 4: Web links with useful information and one additional material in ppt format

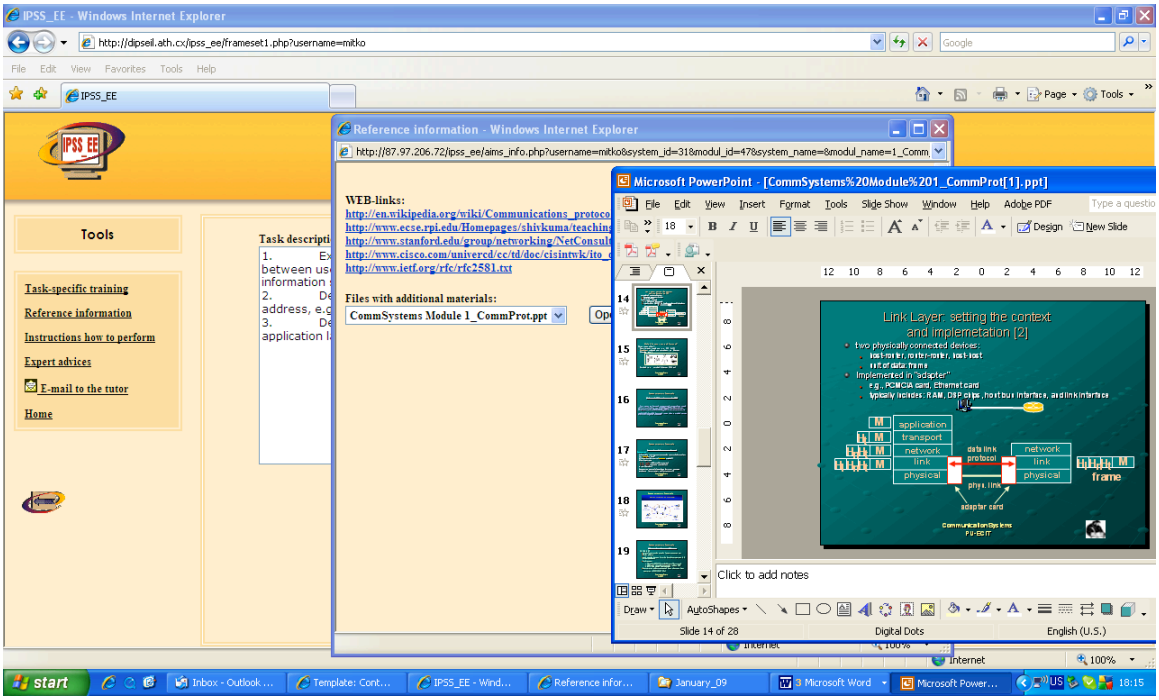
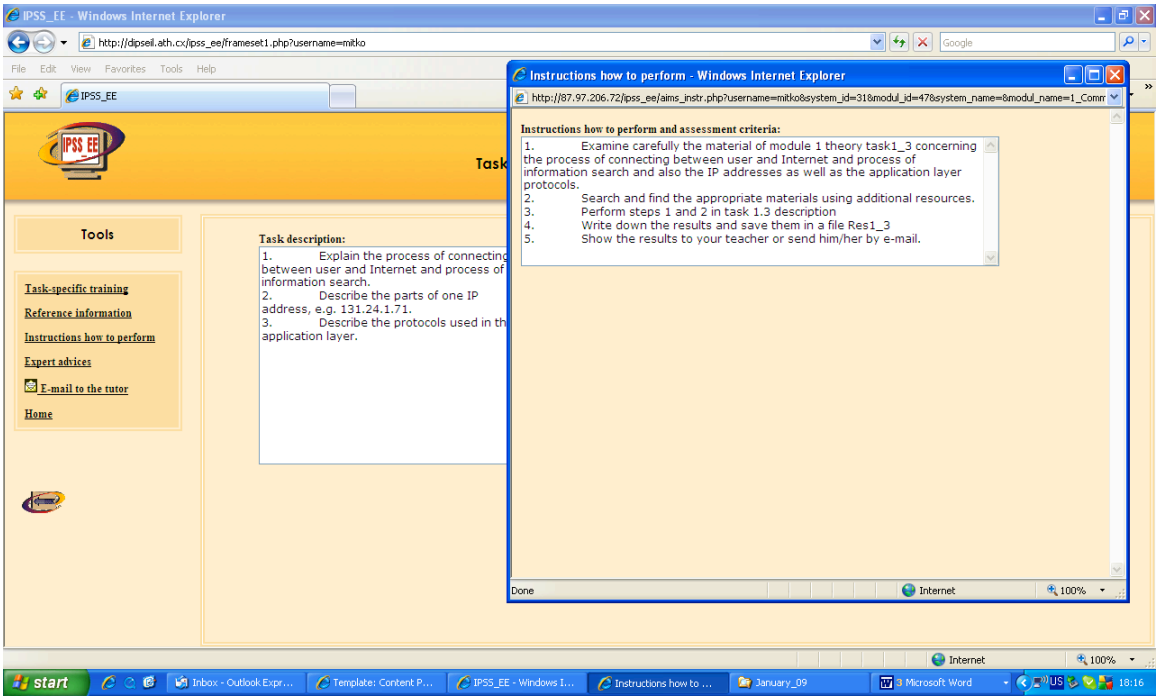


Figure 5: Instructions how to perform — in form of text in a separate window in DIPSEIL



Evaluation

The evaluation strategy in the project aims to study the total purposes of the project, being as our main objective to validate the ICS curriculum.

- The coherence between every course in the ICS curriculum with the PSS (adequacy indicators), by means of our PSS Validity Scale.
- The students' attitude to learn by computer, by one specific questionnaire.
- The usability and functionality of the platform (efficiency indicators), by means of the Computer System Usability Questionnaire.
- The effect of PSS curriculum on students' learning achievement in competencies (efficacy indicators), by means of tests.
- The satisfaction with the PSS curriculum and DIPSEIL platform (when the course has finished) (satisfaction indicators), by means of questionnaires, focus groups, interviews.

The PSS Validity Scale (Adequacy)

PSS Validity Scale	Results
1. State a reference situation in which the students will use what they are going to learn	This element didn't appear in all the courses
2. Formulate a few learning goals and clear and specific objectives oriented to competences	This element always appear in all the courses
3. Create learning tasks, providing to the students: • background information, • examples, • procedures, and • feedback	This element always appear in all the courses
4. Summative evaluation	This element always appear in all the courses

The Attitude to Learn by Computer

Attitude is considered one variable that should be controlled, because one positive attitude or a negative one affect to our research purpose. The questionnaire was integrated by 20 items of Likert answer scale from 1 (less) to 5 (maximum) agreement. It was answered by 10 students. For three students this is their first course online. The following items received 4.5:

- I enjoy working in Internet environment;
- I find very positive the idea of using computers and Internet by study different subject matters.
- The items mean was over 4.26 showing a positive attitude.

The Computer System Usability Questionnaire

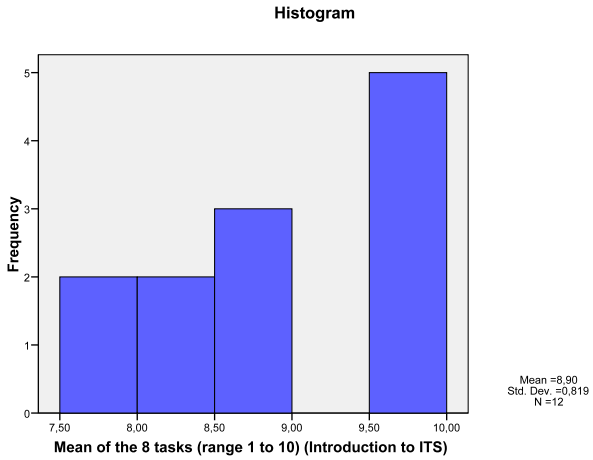
The questionnaire was used to determine opinions on the usability and functionality of the IPLECS platform. The questionnaire was integrated by 19 items, Likert scale, from 1 to 7, maximal disagree to maximal agree with the item. The item better valuated, and others items very well valuated:

- It was easy to learn to use the system (6.60)
- The organization of information on the system screens is clear
- I am able to efficiently complete my work using the system

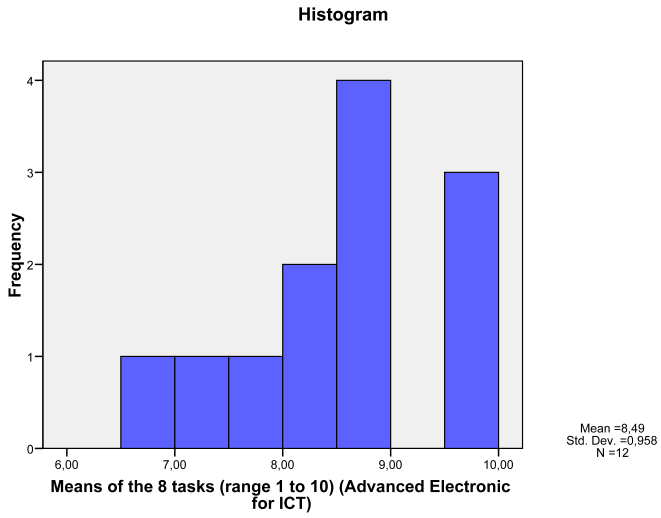
All the items received a valuation over 5.50, (Mean = 5.94, S.D. = 0.267) showing a positive valuation and agreement between the students.

Effect of PSS Curriculum on Students' Achievement in Competencies (Efficacy)

Introduction to Information and Telecommunication Systems					
Students	Tasks	Range	Mín-máx	Mean	St.D
12	8	1-10	7.75-10	8.90	0.89



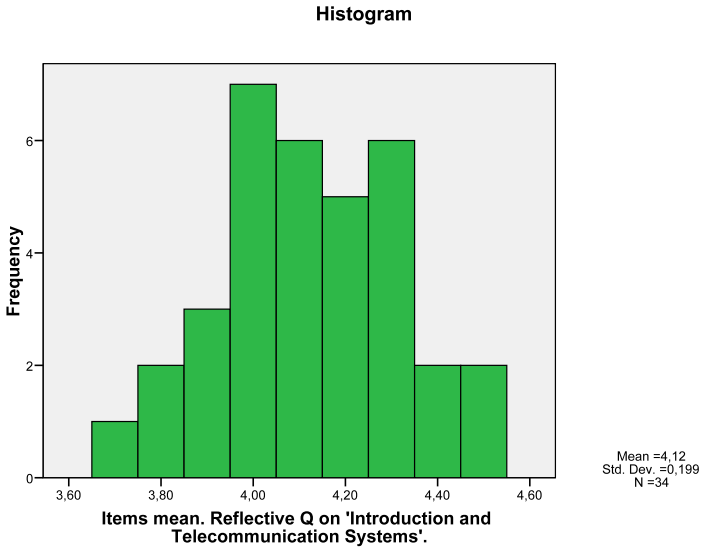
Advanced Electronics for Information and communication Technology					
Students	Tasks	Range	Mín-máx	Mean	St.D
12	8	1-10	7.25-10	8.49	0.95



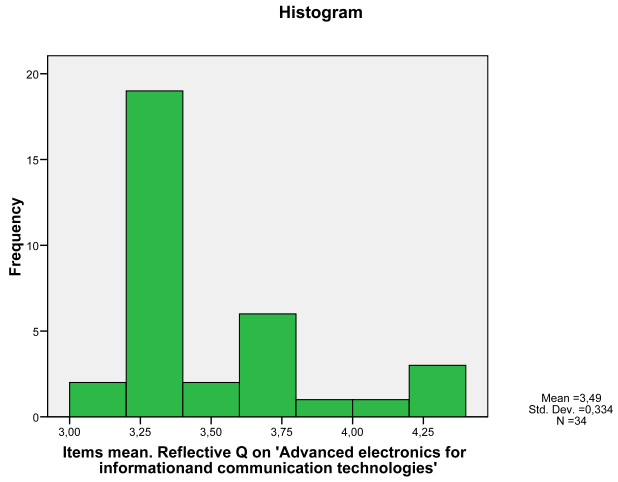
Satisfaction with the PSS curriculum and the DIPSEIL platform

The 'Reflective Questionnaire' on the general instructional design was answered by 10 students in every course applied in the recent finished first semester. The questionnaire was integrated by 29 items, Likert scale, from 1 to 5, maximal disagree to maximal agree with the item. We can see the resume of the descriptive statistics of the two courses evaluated by the students.

Reflective Q. on 'Introduction to Information and Telecommunication Systems'			
Students	Range	Mean	St.D
10	1-5	4.12	0.11



Reflective Q. on 'Advanced Electronics for Information and communication Technology'			
Students	Range	Mean	St.D
10	1-5	3.49	0.33



Conclusions

- The PSS validity scale gives heterogeneous results depending on the different courses.
- The students' attitude to learn by computer is very positive and homogeneous in the students.
- The usability and functionality of the platform, according wit the students answer, present adequate the screens organization and is very easy to learn.
- The effects of PSS curriculum on students' learning achievement in competencies in the two subjects evaluated have been very positive, with very good marks in the tasks.
- The satisfaction with the PSS curriculum and the IPLECS platform on the two courses evaluated by means of the Reflective Questionnaire show a high satisfaction.

Lessons Learned and Improvement Necessities

- In order to get a better adequacy to the instructional purpose of the DIPSEIL model is necessary that the authors, or curriculum developer and the instructional group design make and effort to work together and adjust the courses to the PSS Model.
- Some changes should be done in the different instruments to collect information.
- We need to analyze information collected by focus groups and interviews.

Acknowledgment
The authors would like to acknowledge the support of the European Union Socrates in the projects:
- IPLECS. 141944-LLP-1-2008-1-ES-ERASMUS-ECDSP
- mPSS Leonardo Project 142788-LLP-1-2008-1-BG-LEONARDO-LMP.

References

Bransford, J., Slowinski, M., Vye, N., & Mosborg, S. (2008). The learning sciences, technology and design for educational systems: Some thoughts about change. In J. Visser & M.Visser-Valfrey (Eds.), *Learners in a changing learning landscape* (pp. 37–66). Dordrecht, NL: Springer.

Colins, A., Joseph, D., & Bielaczyc, K. (2004). Design research. Theoretical and methodological issues. *The Journal of the Learning* Sciences, *13*(1), 15–42.