World Applied Sciences Journal 20(Special Issue of Pedagogy and Psychology): 13-19, 2012
ISSN 1818-4952

DOI: 10.5829/idosi.wasj.2012.20.10004

Interdisciplinary Coordination in the System of Foreign Professional Education of Future It-Specialists

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Abstract: The questions connected with coordination of foreign professional education of future IT-specialists on the basis of interdisciplinary curriculums are reviewed in the article. A special attention is paid to determination of the IT-field sets (IT Specialties, IT-Intensive Disciplines, IT Infrastructure), to peculiarities and models of foreign languages integration into curriculums and also the organization of foreign languages education of future IT-specialists within the programs (curriculums) at Carnegie Mellon University and Stanford University are reviewed in the extract.

Key words: Future IT-specialists · Interdisciplinary curriculums · Foreign professional education

INTRODUCTION

Higher education is generally recognized as preparing individuals to realize more fully their human and professional potential, enrich their understanding of life and make them more productive to society.

Future specialists in various fields of science, technology, economies and art get a fundamental general and specialized training, but all students regardless of their specialty study foreign languages. We are convinced it is very important for future IT-specialists to be not skilful users of computers only, but to speak at least one foreign language.

Thus, in the article we consider the problem connected with effective organization of foreign professional education of future IT-specialists on the basis of interdisciplinary curriculums as well.

The Main Part: The existing diversity of theoretical approaches in the area to be analyzed might suggest its importance (M.J. Amey, D.F. Brown [1]; J.D. Austin, J. Hirstein, S. Walen [2]; S.A. Barab, A. Landa [3]; J.L. Caviglia, J. Hatley [4]; Do, Ellen Yi-Luen [5]; D. Franks, P. Dale, R. Hindmarsh, C. Fellows, M. Buckridge, P. Cybinsky [6]; J.K. Graybill, S. Dooling, V. Shandas, J. Withey, A. Greve, G.L. Simon [7]; Ali, Khorsandi Taskoh [10]; L.R. Lattuca, L.J. Voight, K.Q. Fath [12]; J.E. Miller [13]; Peter J. Denning, Ravi Athale, Nada Dabbagh, Daniel Menascé, Jeff Offutt, Mark Pullen, Steve Ruth, Ravi Sandhu [14]; E.B. Nuhfer [15]; J.D. Orton, K. Weick [16]; J.E. Sorensen, D.P. Wittmer [18]; A.H. Van De Ven, M.S. Poole [20]).

The very notion of «integration» incorporates the idea of unity between forms of knowledge and the respective disciplines (Pring, 1973) [17].

An interdisciplinary curriculum can be closely related to an integrated curriculum. Some educators represent the view that knowledge in interdisciplinary studies is a repackaging and, perhaps, enhancement of discipline-based knowledge (Kain, 1993) [9]. In Jacobs' (1991) [8] definition, interdisciplinary means conscientiously applying methodology and language from more than one discipline to a theme, topic, or problem.

Whether a curriculum is interdisciplinary or integrated is not the main issue. Rather, the focus should be on designing a curriculum that is relevant, standards based and meaningful for students. At the same time, the curriculum should challenge students to solve real world problems.

Educational researchers have found that an integrated curriculum can result in greater intellectual curiosity, improved attitude towards schooling, enhanced problem-solving skills and higher achievement in college (J.D. Austin, J. Hirstein and S. Walen, (1997) [2]; Kain, (1993) [9]).

S.A. Barab and A. Landa (1997) [3] indicated that when students focus on problems worth solving, motivation and learning increase. Some schools have

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used an integrated curriculum as a way to make education relevant and thus a way to keep students interested in school (Kain, 1993) [9].

A number of organizations support integrated learning.

Project 2061's benchmarks for science literacy calls for an interdisciplinary, integrated development of knowledge organized around themes that cut across various science disciplines, mathematics, social studies and technology (American Association for the Advancement of Science, 1993).

The National Science Education Standards (National Research Council, 1996) and the Mathematics Standards (National Council of Teachers of Mathematics, 1989) also promote integrated learning. The pending Technology Education Standards (International Technology Education Association, 1998) actually include a major section on making «technological connections». This section refers to ways that technology education relates to other disciplines.

The IT field has been maturing rapidly from a set of technology-oriented, autonomous disciplines into a profession. The IT profession comprises all the professionals who make a living helping other people with the concerns, breakdowns and opportunities that IT causes for them.

The specialties of the profession are many (over three dozen) and diverse. They can be grouped into three sets. The IT specialties are concerned with aspects of computing and networking technology itself; the IT-Intensive disciplines have other concerns that they pursue with a heavy dependence and investment in IT; and the IT infrastructure areas are staffed by professionals who implement, maintain, operate and repair IT (Table 1) [14].

Future IT-specialists should have multiple opportunities to apply their knowledge of languages in a variety of curricular contexts, not just within the traditional language classroom.

Languages Across the Curriculum (LAC) is an initiative to infuse foreign language across the curriculum, thus building on the skills of language proficient students in courses where foreign language sources are not a regular component of the curriculum.

LAC is the name given to a family of curricular models through which students can use their foreign language skills in courses in other disciplines. It implies the collaboration of foreign languages faculty with colleagues from other fields. Faculty involved in LAC is committed to bilingualism as a worthy educational goal and to the belief that multicultural and multilingual approaches to all disciplines are not only enriching but obligatory in a multicultural and global society.

LAC promotes the internationalization of the curriculum, cross-cultural and multilingual inquiry, proficiency in a second language and commitment to bilingualism beyond the confines of a language major and the dismantling of traditional barriers dividing disciplines.

Table 1: The IT-field sets

IT Specialties	IT-Intensive Disciplines	IT Infrastructure
Artificial intelligence	Bioinformatics	Computer technician
Computer science	Cognitive science	Help desk technician
Computer engineering	Digital library science	Network technician
Computational science	E-commerce	Professional IT trainer
Database engineering	Genetic engineering	System administrator
Graphics	Information science	Web services designer
Human computer interaction	Information systems	Web identity designer
Network engineering	InfoSec and Privacy	
Operating systems	Instructional design	
Performance	Knowledge engineering	
engineering	Mgt information systems	
Robotics	Multimedia design	
Scientific computing	Telecommunications	
Software architecture		
Software engineering		
System security		

In order to implement LAC, faculty will need to develop courses and independent studies combining different disciplines with foreign languages, normally at the post-fourth semester level, but also at the elementary and intermediate levels as well. Students can benefit from LAC at any level of language proficiency. Curricula models depend on institutions, faculty and goals. Foreign language faculty will be required to work with content outside their areas of expertise. Faculty from other disciplines may have to refresh their language skills to a certain level for team teaching in LAC courses.

Although expected outcomes will vary from campus to campus, from course to course and even from student to student, in general students will have the ability to interpret the gist or general sense from a written or spoken text; the ability to communicate on topics in the non-language field and a more global perspective in general and within the discipline being studied.

There are some LAC models that should be applicable in the foreign professional education of future IT-specialists.

Adjunct Model: It consists of a course in a non-language field with a one-hour «adjunct» or «trailer» foreign language section. Increased language capability is one of the goals of the course in terms of learning specialized vocabulary and learning to recognize or produce the type of argumentative or expository form that is preferred in the particular discipline.

Parallel Model: It consists of two independent courses, one in a language and one in another discipline. At some institutions, students may enroll in just one of the courses, with the option of participating in a fourth hour joint adjunct section in the target language that has been prepared collaboratively by both instructors.

Fusion Model: In this model the section in the foreign language is internal to the course and all students participate in it. The level of the language is not too high - it requires the ability to read documents, letters, etc.

Combined Model: The professor teaches in the foreign language but students read and write essays in English. Class discussion is also in English. (The information provided here comes from Next Steps, LAC, a publication from the American Council on Education and from Brown U. website on LAC).

Let's consider the organization of foreign languages education of future IT-specialists in a context of investigated problem at Carnegie Mellon University and at Stanford University.

- Carnegie Mellon University (Pittsburg, USA) is one of the leading centers in the field of researches and education in spheres of cybernetics, development of the software engineering and management of information technologies. An extensive structure of university includes CIO Institute, Software Engineering Institute and Center of Computer Safety CERT/CC.

Carnegie Mellon University is recognized the best in the field of algorithms, the computer networks, the distributed calculations, programming languages, robotics, computational linguistics, software engineering.

Foreign languages education of future IT-specialists at Carnegie Mellon University is carried out at School of Computer Science /Language Technologies Institute (LTI)/ on the following programs [11]:

- Ph.D. Program in Language and Information Technologies

The aim of this program is to study the computational linguistics, machine (technical) translation, information management and to train future IT-specialists to understand the grounds of foreign-languages speech on narrow-purposed professional subjects (Table 2).

Table 2: Ph.D. Program in Language and Information Technologies

	Semester 1	Semester 2
Year 1	Linguistic Basis of NLP	Machine Translation
	Algorithms for NLP	Artificial Intelligence
	Self-paced Lab	Self-paced Lab
	Research	Research
Year 2	Software Engineering for LT (I)	Software Engineering for LT (II)
	Statistics for NLP	Principles of Translation
	Research	Research
Year 3	Teaching (TA)	Thesis Proposal
	Research	Research
Year 4	Elective or Seminar	Elective or Seminar
	Research	Research
Year 5	Research	Thesis Defense

LTI / Portugal Ph. D. Program - Double Degree: Ph. D in Language and Information Technologies (in cooperation with Portuguese universities).

Students are offered to participate in the following seminars:

- Joint Speech Seminar 2011: Beyond the User-Item Matrix: Recommendation Techniques for Social Settings; Applications of weighted finite state transducers in à speech recognition toolkit; Subword-based Pronunciation Modeling for Non-native Automatic Speech Recognition; Robust MFCC extraction for text-independent speaker verification; Deployed Spoken Dialog Systems' Alpha and Omega: Adaptation and Optimization; Featuring Emotion etc.;
- Machine Translation: informal discussion in groups during which students submit their research projects on machine translation;
- LTI Colloquium - seminar on discussion of modern problems connected with usage of foreign languages as a mean of communication: Text-Driven Forecasting: Meaning as a Real Number; Understanding and Modeling Dialogue among Peers and its Role in Language-Learning; Representation and Learning of Protein Distributions and Cellular Organization; Measuring Search Engine Utility; Class-Based Contextualized Search; Coarse-to-Fine Inference in Natural Language Processing; Learning to Behave by Reading; Words Eye: Creating 3D Scenes from Natural Language Text etc.;
- LTI Student Research Symposium - presentation and discussion of students' projects on the problem of polyfunctionality of foreign languages application in the academic and scientific fields.

Topics Suggested for Discussion: Integrate Multilingual Web Search results using Cross-Lingual topic Models; Modeling Accommodation in Conversation using HMMs; Word relatives Finder: Inferring Relations from N-gram Data; An Analysis of Route Directions; Phrase Breaks for Synthetic Voices in Low-Resource Languages; Augmenting Language Models in Speech Translation with Explicit Context and Feedback etc.;

- Carnegie Mellon University Information Retrieval Discussion Series: students scientific discussions between numerous research student's groups are carried out, for example, on such subjects: Rank Learning for Factoid Question Answering with Linguistic and Semantic Constraints; Vertical Selection in the Presence of Unlabeled Verticals; Collecting High Quality Overlapping Labels at Low Cost; Exploiting Sequential Relationships for Familial Classification etc.;
- Large Scale Lunch Seminar Series: monthly presentations and projects' discussions on the basis of the advanced computer technologies. Language of discussion - English. For example, Distributed Asynchronous Online Learning for Natural Language Processing;
- Intelligence Seminar: this work is connected with discussion of problems on scientific subjects: Computational Social Choice:

A Decision-Theoretic Perspective; Going Beyond NP: New Challenges in Inference Technology; Structure and Knowledge in Natural Language Processing; Computing Game-Theoretic Solutions for Security etc.

M. S. Program in Language and Information Technologies (2 years), (Table 3).

Undergraduate Minor in Language Technologies - this program deals with studies of language technologies and the opportunities of their usage in project activities (Table 4).

Besides, for future IT-specialists are offered special works in the field of scientific researches (so-called LTI Projects by Research Area): Machine Translation; Information Retrieval; Language Technologies for Education; Computational Biology; Other, Interdisciplinary Projects; Speech; Knowledge Representation, Reasoning and Acquisition; Dialogue; Natural Language Processing/Computational Linguistics; Older Projects.

Also the students of School of Computer Science take part in special seminars (LTI Sponsored Seminars) at which they can improve their practical abilities in such spheres of educational and scientific activity as: Joint Speech Seminar, Machine Translation, LTI Colloquium, Student Research Symposium, Intelligence Seminar, Crowdsourcing Lunch Seminar.

Stanford University, the well-known higher educational establishment, is famous for its technical and applied disciplines.

Preparation of future IT-specialists (Information Technology, Nanoscience and Nanotechnology) in the field of foreign languages is carried out at School of

Table 3: M.S. Program in Language and Information Technologies (2 years)

	Fall Semester	Spring Semester	Summer
Year 1	Grammars and Lexicons	Information Retrieval	Required Research
	Algorithms for NLP	Machine Translation	
	Directed Study	Self-paced Lab	
		Directed Study	
Year 2	Software Engineering for LT (I)	Software Engineering for LT (II)	Required Research
	Speech	Directed Study	
	Understanding	Elective	
	Self-Paced Lab		
	Directed Study		

Table 4: Undergraduate Minor in Language Technologies

	Course	Name	Credits
Core Courses (2)	11-721	Grammars and Lexicons	12, F
	15-482	Human Language Technologies	12, F
Electives (Any 2)	15-492	Speech Processing	12, F
	11-411	Natural Language Processing	12, S
	11-441	Search Engines and Web Mining	12, F
	11-617	LT in CALL	12, S
	11-711	Algorithms for NLP	12, F
	11-731	Machine Translation	12, S
	11-741	Information Retrieval	12, S
	11-751	Speech Recognition	12, F
	11-752	Speech II	12, S
	11-761	Language and Statistics	12, S
	80-180	The Nature of Language	9, F
	80-280	Linguistic Analysis	9, S
Project (Choose 1)	A semester-long directed research project	12, F/S	
	A paper to provide hands-on experience and an in-depth study of a topic (in same area as à chosen elective)		

Engineering by The Language Center (Stanford University affiliated). The Language Center at Stanford University offers students the opportunity to get a degree within a great number of programs and courses connected with foreign languages education (Language Programs and Courses) [19].

- African and Middle Eastern Languages - learning of Middle Eastern Languages and languages of African group.
- Basque Program - learning of Basque language and history and cultural heritage studies (Basque Country). The aim of the program - effective communication in the academic and professional purposes.
- Catalan Program - the program offers students to study the following courses:

Catalan 1 A - the course is developed specially for those who already know one foreign language of Romance group, it is preferable - Spanish. The accent is focused on social and cross-cultural communication. This is an introduction course.

Catalan 2 A - the course is developed specially for those who already know one foreign language of Romance group, it is preferable - Spanish. The accent is focused on social, cross-cultural and some aspects of professional communication. This is the first year of study.

Catalan 11 A - the course is developed to integrate studies on culturological and language aspects of Catalan dialect. The attention is focused on written communication (formal, informal style; academic, professional context). This is the second year of study.

- Chinese Program -the program gives the opportunity to learn Chinese for academic and professional communication and cross-cultural communication.
- The English for Foreign Students Program - the program is offered for foreign students who study English as the second foreign language. The course improves skills of colloquial English, as well as strengthens accents of professional communication.
- French Program - the course helps students to improve a wide range of skills of communication in French: in listening comprehension, in dialogues, in written activities, in reading and grammar.

- German Program: within the program students are offered to get a degree in the following courses: Individually Programmed Beginning German; Intermediate and Advanced courses: German 21: Intermediate German I; German 100: Hundert Deutsche Jahre; German 101: Advanced Language Study I; German 110: Newspapers; German 111: Television News from Germany.
- Italian Program - the program suggests students to take part in studies and discussion of various aspects of rich cultural and historical heritage of Italy.
- Japanese Program - improvement of skills of modern Japanese by means of participation in Japanese Language, Culture and Communication Courses at such levels: Graduate Level Course (Advanced); Japanese Language Essentials Courses (First-Year/Second-Year); Conversation Courses (Intermediate Conversation; From Intermediate to Advanced; Advanced Conversation; Summer Intensive Courses (First-Year/Second-Year); Other Courses (Accelerated Japanese; Japanese for Professionals; Japanese Through Films).
- Korean Program - the program deals with Korean language studies and offers the following levels of preparation: Beginning, Intermediate, Advanced-Intermediate and Advanced. The program aim is to improve the foreign-language competence of students in the academic, professional spheres and to develop the skill of cross-cultural communication.
- Portuguese Program - the program is focused on Portuguese language studies and offers the following levels of preparation: Accelerated First-Year Portuguese (improvement of reading skills, written skills, communicative skills); Second-Year Portuguese (improvement of listening comprehension skills, written skills: writing of business correspondence; improvement of communicative skills, reading skills). The students are offered Portland Courses also: the can study lexicology, grammar, phonetics; skills of written and oral speech in the academic and professional spheres.
- Russian Program - the program is devoted to Slavonic languages studies, including sets of regional geographic data on Russia (features of Slavonic languages, works on projects, the organization of individual work of students and individual consultations, etc.).
- Spanish Program - the program in Spanish languages studies offers the following levels: Spanish 10: Elementary Oral Communication; Spanish 15: Intermediate Oral Communication; Spanish 100: Advanced Oral Communication; Spanish for Home Background Learners; Spanish 21 B, 22 B, 23 B: Intermediate Spanish for Home Background Learners.

The aim of the program is improvement of foreign-language competence of students in the academic, professional spheres and development of cross-cultural communication skills.

- Special Language Program - the program deals with studies of specific foreign languages, i. e. those languages which in the sphere of business communication aren't used widely (American English for deaf, Albanian, Czech, Hawaiian, Hindi, Hungarian, Kazakh, Kyrgyz, Greek, Polish, Romanian, Ukrainian, Uzbek, Vietnamese etc.). Also the questions connected with cross-cultural communication are studied.

CONCLUSION

In the conclusion we'd like to mention that interdisciplinary coordination in system of foreign languages education of future IT specialists is considered to be a general principle of modern studies which influences upon selection and structure of curriculum subjects, strengthening systematically the knowledge of students. Interdisciplinary coordination makes active training methods, focuses on application of complex forms of the educational organization, such as interdisciplinary curriculums, which provide the unity of foreign languages studies.

On the results of foreign languages programs and courses review at Carnegie Mellon University and Stanford University we could find out that they are characterized with:

- Interdisciplinary approach (containing information from different areas of knowledge, for example, literatures, arts, stories, politicians, geography, informatics, etc.);
- Multilevelness (combining the various language means corresponding to aspects of language: lexical, grammatical, phonetic, with another - abilities in four types of communicative activities);
- Polyfunctionality (can act as the purpose of education and as the means of getting information in different areas of knowledge).

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