



**PhD in Management
and Business
Administration**

SUMMARY OF THESES

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**Teaching Information Technology in Economics
and Business Administration Training Programs**

Ph.D. dissertation

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I. PRELIMINARIES AND AIMS OF THE STUDY

During many years of teaching I have very often faced the problem that on the basis of debates with teacher colleagues the content of subjects taught has extended, narrowed, changed but in fact the definition of objective was missing, that was the reason why the debates lead us nowhere at all. This study has been inspired by the ambition that basic IT education should focus on the really important key competences that this special area requires, that is Economics and Business Administration Training Programs.

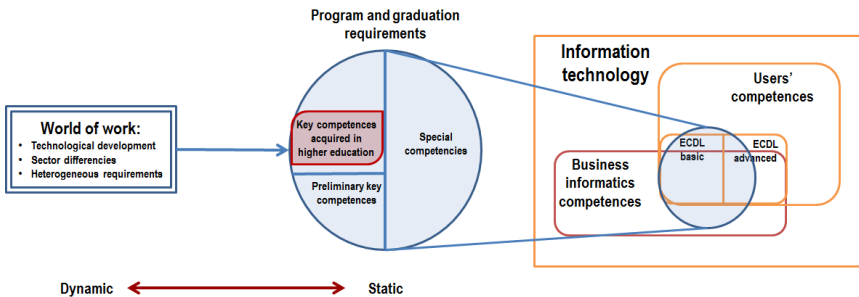


Figure 1 Informatics key competences necessary in courses of economics and business (own design)

The first important step was made with the decision that wished to change from teacher centered education for student centered education, concentrating on the outcome side. The review of the concept of the study is provided by figure 1. The primary aim is that students entering the labour market should be successful. The world of work is changing dynamically and the definition of where exactly the students graduating at the courses examined will turn up in this world is not obvious either. The situation is even more complicated by the current continuously developing technology, sector differences and heterogeneous requirements typical of places of work. This study cannot estimate this dynamically changing heterogeneous group of requirements completely. However, in the higher education there is a concrete static requirement system described by

program and graduation requirements. It is a challenging task to establish such an education which can meet static pro-gram and graduation requirements and it enables students to prepare for a dynamically changing environment they are going to see in the world of work.

Program and graduation requirements contain key and special competencies, the latter ones are more involved in changes, although the circle of necessary key competencies is changing with time but more slowly. For example, nowadays competences connected to mobile technology developing fast will be unavoidable in a short time, although they did not exist some years ago. Special competences are rarely mentioned in the study, because they cannot appear in the basic IT education. The basic IT education is typically present at the beginning of the education, in the first or second term.

It is a tendency deriving from the development of the information society that students step into higher education not lacking IT competences completely. It is also essential to find out what the students take with them, whatever they learn either in secondary school in formal environments or in informal ways.

Concerning all mentioned above, I am looking for answers to the following questions:

(K1) What should the aim and content of basic Information Technology courses be in the economics and business administration training programs?

In order to answer the main question I am looking for answers to the questions below:

(A1) What kinds of IT competences are needed in the economics and business administration training programs, within it at economics and business educational courses, according to program and graduation requirements as well as European Union directives?

- (A2) *What kind of IT education is provided for students of Economics and Business administration training programs?*
- (A3) *What kinds of differences can be experienced between the program and graduation requirements, European Union directives and present home practice?*
- (A4) *What kinds of knowledge and skills can we rely on during the education?*
- (A5) *What kinds of IT key competences are necessary for graduates of economics and business administration training programs when entering work?*
- (A6) *In what areas is there a difference between IT key competences possessed already at starting university and at a work place?*

In order to validate results of research, the practical implementation of theoretically proved statements is necessary. One possible form of it is *compiling an up to date curricula, meeting the expectations of Bologna process, program and graduation requirements, workplace standards, taking marginal conditions into considerations.*

II. METHODOLOGY

I wished to change from a teacher centered education for a student centered education, concentrating on the outcome side, too. This fundamental change of thought is supported by a wide-scale pedagogical bibliography available, which I am going to present in chapter III.1. as well as the Bologna process, determining the transformation of European higher education in the last few years presented in chapter III.2. In these chapters I am going to define base terms used in my study: competence, declarative and procedural knowledge, skills, ability, attitude, student-centered teaching.

The concrete special area that I am working with along these aspects is IT key competences that are necessary at Economics and Business Administration training programs. The economics and business administration training programs are divided into two course groups according to the Hungarian program and graduation requirements and in the international literature, too, that is, economics and business courses. In Hungary economics courses are Applied Economics, Quantitative Economic Analysis (earlier Economic Analysis) and Public Services, business courses are Human Resources, Business Administration and Management, Commerce and Marketing, International Business Economics, Finance and Accounting, Tourism and Catering and Vocational Instruction. The study does not deal with the latter one (Vocational Instruction). I am going to revise the educational area in chapter III.3.

Since IT education is the main issue, I find it important to mention IT Body of Knowledge in chapter III.4., but first of all I put the emphasis on the meeting points of areas of sciences in chapter III.5.

The legal review of secondary school curricula is in chapter III.6. the review of the quite well-known IT users' exam system, ECDL is included in chapter III.7.

Next to theoretical reviewing I carried out empirical examinations to be more precise regarding the topic. I am going to present the plans of research in chapter IV., the concrete results in chapter V. I turned to graduates and present students with a questionnaire. To reveal the aspects of both science and teachers, I made interviews with teachers and research of bibliography. I used document analysis for the examination of present practice.

III. THE RESULTS OF THE STUDY

III.1. Competences required by Economics and Business Administration training programs (A1)

What kinds of IT competences are needed in the economics and business administration training programs, within it at economics and business educational courses, according to program and graduation requirements as well as European Union directives?

Courses of Economics:

IT Competencies:

- interpret and manipulate economic data (Lee Hansen):
 - explain how to understand and interpret numerical data found in published tables,
 - be able to identify patterns and trends in published data,
 - Construct tables from already available data to illustrate an economic issue,
- effective use of relevant data and quantitative methods (Tuning)
- quantification and design (Tuning):
 - data and their effective organization, presentation and analysis,
 - be familiar with the principal sources of economic information and data,
 - organizing and presenting data informatively,
 - able to structure, analyze and explain information presented in some numerical form,
 - presentation skills to communicate quantitative information in usable ways,

- give critical and coherent summary representations of data that cannot be readily absorbed raw,
- making surveys and reports (Program and graduation requirements),
- preparation for decision making (Program and graduation requirements),
- business information systems (Quantitative Economic Analysis, Program and graduation requirements).

Further competences which are not only connected to IT but appear there, too:

- abstraction (Tuning),
- analysis, deduction and induction (Tuning, Program and graduation requirements),
- framing (Tuning),
- independence (Program and graduation requirements),
- communication (Program and graduation requirements),
- teamwork (Program and graduation requirements).

Courses of Business:

IT competences:

- design and implement information systems (Tuning),
- identify and operate adequate software (Tuning),
- making surveys and reports (Human Resources, Commerce and Marketing, Program and graduation requirements),
- preparation for decision making (Human Resources, Business Administration and Management, Program and graduation requirements),
- computerized, modern analysis methods (Human Resources, Program and graduation requirements),
- presentation (Program and graduation requirements),

- application of modern IT technologies (Finance and Accounting, Program and graduation requirements),
- knowledge of Finances and Accounting Systems (Finance and Accounting, Program and graduation requirements),
- knowledge Personal Management Systems (Human Resources, Program and graduation requirements).

Further competences which are not only connected to IT but appear there, too:

- independence (Program and graduation requirements),
- communication (Program and graduation requirements),
- ability for analysis (Program and graduation requirements),
- teamwork (Program and graduation requirements).

Obviously the enumeration does not cover the complete scope of the necessary IT competences.

In the frame of the special base material IT is included in two courses. At the course of Human Re-sources, there is Personal Management Systems, Finances and Accounting System at Finance and Accounting course.

The general competences defined for the complete higher education in the Tuning project, which are related not exclusively to IT but appear there, too:

- problem solving,
- analysis and synthesis,
- application of knowledge in practice,
- capacity to learn,
- adaptability to new situations,
- work autonomously,
- concern for quality.

It can be clearly seen from the comparison of economics and business courses that in the case of the former one we can find a more detailed guideline in the area of IT or competences closely related to it and these are in connection with analysis and data processing primarily. At business courses presentation skills and the knowledge of different information systems get more emphasis. The difference emerging in operative documents does not completely meet real requirements as data analyzing competences present at economics courses are just essential as at business courses.

III.2. Current IT education (A2)

What kind of IT education is provided for students of Economics and Business administration training programs?

I could gain insight into the current home practice with the help of subject data forms and subject descriptions available on the websites. Due to lack of information I was able to compare IT, mainly knowledge and skills elements out of competences specifically.

It is typical of the Hungarian practice that institutions show a greater similarity than courses. According to data of 2010, there were 2 compulsory IT subjects on average in the operative curricula. More informatics was taught at Business Administration and Management and Finance and Accounting courses (business courses) but less at Public Services course (economics course). The credit number of compulsory subjects was varying between 1 and 5.

Out of the IT subjects of 17 institutions it was typical of 8 basic IT subjects that computer science basic knowledge as included: hardware, knowledge of operation systems. In practice, the basis of word processing, spreadsheet and presentation making was provided. In further

two, basic subjects the theoretical data protection, data security appeared whereas in practice more advanced spreadsheet (data analysis) were included. In still more, 7 compulsory subjects business and other information systems were present. In 2 compulsory subjects quite advanced spreadsheet, data analyzing and modeling, whereas in 4 subjects database-management could be seen.

Moreover, the scale of optional subjects is very wide but it also differs a lot in institutions, among them we can find subjects that are analyzing and showing information systems as well as subjects about the web.

In 2013, at business courses of BCE there was one compulsory and one compulsorily optional IT subject (4 and 3 credits, respectively) at BCM there were 2 compulsory subjects for 3-3 credits. In both institutions spreadsheet was the practical material next to theoretical basics. Moreover, in college, at lessons of practice there was word processing, presentation and database management. At university, at Finance and Accounting and Human Resources courses there is Excel programming. At university the compulsorily optional subject is about information systems. Among course subjects at Business Administration and Management course there was e-business, at Finance and Accounting they taught Finance and Accounting System and at Human Resources, Personal Management System. At college at Business Administration and Management at certain specialization there was an IT subject accordingly. Optional subjects are available in both institutions, at university on a larger scale.

In 2013 there was one compulsory subject for 4 credits at economics courses at BCE, theoretical basic knowledge, in practice spreadsheet

and Excel programming and at Economic Analysis course there was Maple. IT course subjects are not involved at such courses at all. At the Public Service course of BCM there are two compulsory IT subjects, just like at business courses. The scale of optional subjects is the same as at business courses, the course of Economic Analysis has one more optional subject including Excel programming (they did not include it into the compulsory curricula).

III.3. Differences between Program and Graduation Requirement and practice (A3)

What kinds of differences can be experienced between the program and graduation requirements, European Union directives and present home practice?

Identification of differences can only be accomplished in part, as only subject descriptions were available for me, from the current home practice, which did not reveal whether other competences appear in the curricula and if they do, in what way.

It is a striking difference that in the analyses of both 2010 and 2013 theoretical basis of IT, different kinds of hardware knowledge, operation system, computer science were all significantly present, however, they are not included in the Program and Graduation Requirements and the European guidelines at all, at least not explicitly. In some institutions, word processing skills also appeared in practice, which did not appear explicitly on the other side.

However, especially at economic courses there were quite a few data managing, data analyzing competences among the requirements, which were completely missing from the basic informatics teaching material (8 compulsory basic subjects) in the major part of institutions in 2010. (Since then the situation could have changed into a positive direction).

Presentation, interpretation of data, communication are all present among the requirements of both course groups. At the subjects examined presentation appears only rarely and only on a basic level, the communication of data does not appear anywhere explicitly.

The knowledge of information systems on the requirement side among the business courses appeared at the courses of Human Resources and the Finance and Accounting course, thus according to this, when analyzing subjects, I found course subjects with such content at these courses. In the definition of Tuning project in the business area the design and implement of information systems emerged, I did not find anything like that during my subject analysis, but in my opinion this cannot even be a requirement on Bachelor, only on some Master courses.

III.4. Preliminary knowledge and skills (A4)

What kinds of knowledge and skills can we rely on during the education?

Based on reviewing laws and my empirical research, I claimed that students arrive at higher education institutions with a visibly wider scale IT competence than even some years ago and it is probably worth paying further attention to this change, so that the higher education should respond when needed. While carrying on the series of research, it will be interesting to examine at what pace the managing of new technologies will be inserted into students' competences.

Both laws and questionnaires based on self-confession show that basic knowledge of internet, spreadsheet and presentation is acquired by students before they start university. However, there are some areas where the self-confessed knowledge is under the level prescribed by

law. Such a typical area is database management, web design and data analysis.

III.5. The private sector requirements from education (A5)

What kinds of IT key competences are necessary for graduates of economics and business administration training programs when entering work?

In order to answer the question, the union of competences defined by business informatics ontology and users' knowledge and skills defined by and even going beyond ECDL examination requirements must be narrowed so that only the competences relevant from the aspect of economics and business administration subject should be left. While narrowing, we can use the answers received to the previous sub-questions. We must also remove special competences from the competence circle in order to have the necessary key competences left. When defining competences, we must also remember that technology and expectations are changing constantly, so on the one hand the competence of adaptability to changes is essential and on the other hand the points written down at present must be inevitably supervised in some years' intervals.

- The knowledge and application of communication tools from the elements of computer architecture (internet and mobile)
- From the elements of information architecture:
 - Transaction processing, store of data, data input, data collection, primary processing, visualization of results, archiving documents.
 - The knowledge and application of MIS (Management Information System) pivot making, solutions to be automatized-special competence
 - Decision support – special competence
 - Groupwork Management

- Workflow Management –special competence
- The application of executive information service –special competence
- Business Applications:
 - The knowledge and application of ERP systems –special competence
- The skills for tasks solved with different spreadsheet and database managements and communication can be found at the cross section of business informatics and users' competences:
 - Internet and mobile communication,
 - Making table with spreadsheet,
 - Using simple formulas and functions ,
 - Usage advanced functions with spreadsheet,
 - Analyzing data with spreadsheet,
 - Making macro with spreadsheet (advanced usage of spreadsheet),
 - Database management – special competence
- Further necessary competences:
 - Making simple documents with word processor,
 - Making long documents with word processor,
 - Presentation skills,
 - Work autonomously,
 - Adaptability to new situations,
 - Concern for quality

One part of the noted special competences of the enumeration is built into the special subjects appearing at certain courses, their other part can be learnt in the frame of optional subjects. Next to it, one part of the competences, mainly the

workplace specific knowledge will be acquired by the employees already at their workplace.

III.6. Difference between the requirements of the private sector and preliminary key competences (A6)

In what areas is there a difference between IT key competences possessed already at starting university and at a work place?

As it can be read from the answer given to A4, one part of the non-special competences enlisted in the first point has already been acquired by the students entering higher education, for example, the use of internet or the use of basics of word processor or spreadsheet programs. With the development of the information society, the circle of preliminary competences is changing continuously, so not only the answer given to question A5 but even its narrowing must be revised from time to time. According to the present situation the following necessary key competences are still not known by the new students:

1. Groupwork management
2. The application of advanced functions with spreadsheet
3. The analysis of data with spreadsheet
4. Making macro with spreadsheet (advanced usage of the spreadsheet)
5. Visualization
6. Work autonomously
7. Problem solving
8. Adaptability to new situations
9. Concern for quality

III.7. The aim and content of Information Technology basic courses (K1)

What should the aim and content of basic Information Technology courses be in the economics and business administration training programs?

On the basis of the answers given to the sub-questions the main question can be answered already. Based on preliminary knowledge the aim of basic IT courses is to develop such IT key competences and transferable skills in students which help them find their place in the dynamically changing world of work and which they can rely on so that they can acquire the informatics special competences while furthering their studies.

To be able to acquire further special competences effectively, they need to have a firm basis. Learning the expert use of a spreadsheet program can serve this aim. In the special field of economics and business administration examined, the majority of problems can, in fact, be solved, with the help of spreadsheet tools. Research has shown that employees meet these applications most often in the company environment (2., 3., 4 and 5. competences in the enumeration given to question A6). Above this, it is significant help in learning the application of specific programs if the basis of data management and data analysis has already been acquired in a familiar program environment.

Curricula must be built on problem solving. With the help of this, problem solving and work autonomously enlisted among competences in point A6 can be developed. The approach from the aspect of the problem provides a chance for us to create the suitable connecting points towards special competences, and through this to help bring about the ability to adapt to new situations (9.).

The phases of problem solving built on each other can be divided proportionally with the increase of the level of complexity. In the case discussed, complexity

can be described with the circle of kinds of data and the level of difficulty of data processing. The following levels can be defined from the aspect of the topic examined:

1. the static management of data: table making, simple calculations
2. the dynamic management of data; problems to be solved typically with spreadsheet application or ; usage of formulas, visualization
3. the integrated databases management
4. problem solving, finding different applications and integrated management matching

The education cannot obviously integrate the development of technology in time, because it is in vain that we teach the topically latest technology in a certain case, by the time the first year student receives a degree, and starts work, technology shows a further development. In spite of that, aiming at teaching development tendencies at least at a knowledge-level is quite necessary and directions that help students go further into relying on their own course must be outlined. This activity is aided by building concrete educational materials onto relatively more stable elements in the circle.

Acquiring the further 2 competences, groupwork and concern for quality enlisted in the answer given to question A6 can be aided by means of methodology.

IV. VALIDATING RESULTS

In order to validate results of research, the practical implementation of theoretically proved statements is necessary. One possible form of it is *compiling an up to date curricula, meeting the expectations of Bologna process, program and graduation requirements, workplace standards, taking marginal conditions into considerations.*

Declarative knowledge (on the level of knowledge and comprehension): the definition characteristics and types (information, data) of IT basic terminology, the topical and future trends of IT, the information systems of economy and public sector, means of communication, nets, data security.

Skills (on the application level of the cognitive domain)

The evaluation of information on the basis of the characteristics of information. Recognizing data types and the application of data types according to operations.

The competent operation of defined tools of spreadsheet and presentation making applications. The ability of basic operation of one part of the tools enlisted here is acquired by students when starting university, in an optimal case the result of the course will be not only the competent operation alone, but planning of work operations starting out from the problem. Competent operation can be prescribed as a learning outcome (minimum requirement).

Focusing on problem solution following the concrete case study outlined in table 1, we should provide an adequate set of means for the solution of newer problem types arising continuously. These means are application-independent, however, during the completion of the case study, the application of a concrete program package is, in fact, indispensable. (It is mostly still some version of

Microsoft office program package, but students' attention should be also called to some alternative chances, open-source solutions.)

The problems shown in the case study belong to the first two problem levels. In the basic IT education it is not a requirement to reach higher levels for the time being, but through certain problems the case study enables us to present solutions going beyond the chances provided by spreadsheet applications. Such a basic course is not enough to present these in detail but I definitely find the establishment of connecting points important.

Table 1 Problem arising in a complex case study about managing orders and the set of tools necessary for their solution (At the description of the problem, I referred to the problem levels in the bracket)

DESCRIPTION OF THE PROBLEM	CONCRETE TASK	TOOLS
Calculating the counter-value of order deduced from expenses (level 1)	Calculations with defined values	Simple formulas, functions, absolute relative reference
Calculating the counter-value on the basis of order forms received in different formats (level 1)	Import of data into spreadsheet, conversion, so that the calculations could be carried out	Importing, text and date managing tools
Price offer required in foreign currency (level 2)	Inserting topical current price, let us suppose, from arfolyam.hu	Importing from website updating, word processing tools
There are decision variables in the order, for example discount on quantity (level 2)	Formalizing the decision process	Conditional functions (if)
Data must be summed from some kinds of aspects in order to perform orders	writing down conditions	conditional summing functions (countif, sumif)

DESCRIPTION OF THE PROBLEM	CONCRETE TASK	TOOLS
In connection with orders or some of our other data we have to give answers to different ad-hoc executive questions. For example, is there a certain product in store, which product type is ordered most frequently, etc. (level 2)	the representation of the partial set of table lines, making data clear fast	filter, sort, conditional formatting
In the order there are only product names, codes and quantities, other features (unit price, availability at store, etc.) are not provided (level 2)	The suitable data must be searched from our own data tables	Lookup functions
We must make reports for the preparation of executive decisions(level 2)	Making tables for data of orders, making summarizing drill down tables from our data tables (stock, table of costs, orders)	Pivot table
We must present data inside or outside the firm (level 2)	Visualization, making and presenting charts, diagrams	Chart, animation of chart in a presentation
We always get a recurring task, for example an order in the same, but unsuitable form for processing (level 2)	Automation of operations performed	macro recording, modification, running
There should not be a need for the continuous modification of order forms (level 2)	Making a form to be processed automatically	tools of making a form

DESCRIPTION OF THE PROBLEM	CONCRETE TASK	TOOLS
We must support the different alternatives with calculations in order to make a pricing model (level 2)	data tables, sensitivity analysis	data table
We would like to achieve the optimal transport of orders arrived from our different stores (level 2)	Solution of transportation problem	tools for optimization, Solver
We have to make the pricing model, too (level 2)	making the algorithm of mathematical models	macro writing

The higher levels of cognitive domain (analyze, evaluate, create): are not necessary

Attitude: learning outcomes achieved with the help of methodology to a more, in the explicit education material description, to a less extent. Adaptability to new situations, problem solving, work autonomously, concern for quality.

The problem-oriented approach of the whole curricula can ensure the cancelling of the conflict outlined in the introduction between the dynamically changing world of work and the static program and graduation outcomes (figure 1).

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VI. OWN (AND CO-AUTHOR) PUBLICATIONS RELATED TO THE TOPIC

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