

INFORMATICS EDUCATION FOR UNIVERSITY STUDENTS OF THE ECONOMY AND MANAGEMENT IN DISRUPTIVE TIMES

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Abstract: *Plenty of universities offer students e-courses already in the first year of their studies. The point is whether students coming from secondary schools are ready to use the offered eLearning tools and the potential to the full. Especially for the development of students' key competencies. This article describes the basically framework schema of teaching during which students acquire competences in the field of ICT and e-learning enabling them to use ICT in the process of teaching. The paper presents and analyses the results of our research in teaching Informatics at the Faculty of Management and Economics (FaME), Tomas Bata University (TBU) in Zlín. In the paper, we present the results of the knowledge evaluation from our survey in the period 2013 –2017. Also we discuss how to educate the future economists and managers – advanced users of business informatics, information and communication technologies (ICT) and information systems. At the same time the results of analysis, including evaluation and experience of the tutors are presented herein.*

Key words: *Education, educational technology, informatics, knowledge, research, innovation*

1. INTRODUCTION

Learning, not only at universities in an individual mental work: the more deeply and especially mentally process a substantive content, the better we understood. Foundations must be laid on quality education from an early age. Determining the level of existing knowledge of the student is an important prerequisite for continuing education at all levels, including tertiary level. As we work at the Faculty of Management and Economics (FaME), that is the reason why we often look at informatics education from the economists' and managers' point of view and we consider this interesting and useful. A main question we are dealing is to find out whether the future economists and managers are adequately prepared from the point of view of the competitiveness on the labour market. The article reviews the results of the knowledge evaluation of the future economists and managers in the subject Informatics for Economists and their analysis. Determining the level of existing knowledge of the student is an important prerequisite for continuing education at all levels, including tertiary level.

2. EDUCATION SYSTEM AND CURRENT TRENDS IN DISRUPTIVE TIMES

Knowledge, the implementation of ICT and innovations are considered to be the key factors of success that can ensure economic growth for individuals, companies even for whole countries. Because knowledge and information have become the most important currency for productivity, competitiveness, and increased wealth and prosperity, nations have placed greater priority on developing their human capital. Governments around the world are thus focusing on strategies to increase access to and improve the quality of education. Information and knowledge society requires computer and information literate citizens. Education today is under pressure from various views and reforms, which are often contradictory. Knowledge is the main

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engine of the future economic growth. Information and knowledge society requires computer and information literate citizens. It is doubly true for university graduates. Experience of the evaluation of the course Informatics for Economists, particular aspects of ICT education show the publications in scientific journals. [1], [2]

In recent years, several advanced countries have declared the intention to transform their ICT school subject into a new Computer Science, Informatics, or Computing education. The basic idea of culture, including school culture, consists of shared meanings and common understanding, and this culture is variable from school to school and characterized in [3]. In the article [4] stated that schools are expected to do in order to promote economic competitiveness often contradicts commonly accepted global education reform thinking. Key competences were defined and also accepted e.g. in the document [5]. The document says that „*Competences are defined as a mixture of knowledge, skills and attitudes appropriate to the situation. Key competences are those, which people need for personal development, social integration, activity and employment*”. As the theoretical conception can be characterized by the principles [6]. Recently, we have accepted many educational models, teaching strategies, teaching concepts and methodologies in the Czech education system according to [7].

Every few years a new disruptive technology emerges, i.e. something that fundamentally changes the way we do things. disruptive technologies: strategies for enhancing the learner experience and quality. Decision makers find themselves asking key questions: What defines a quality education in today's global information-based economy? Has education kept pace with a rapidly changing world? With the Internet, educational institutions moved from communication through paper memos to ubiquitous use of email, similarly all departments have a web presence, both to promote the department's activities generally and to have at least some presence in terms of course offerings. Mobile phones have made landlines virtually redundant; and the functionality of today's smart phones means that they are used for far, far more things than simply making a phone call. Virtual Learning Environments made educational institutions realise that technologies were an essential part of the service they offered students.

Other trends in the field of using ICT, which can be found e.g. in [8] are:

- Any function on any device, accessible anywhere and anytime, BYOD (Bring Your Own Device) principle.
- Smarter things – as mobile robots, the wireless device power, machine-to-machine communication services, mesh network sensors, home health monitoring.
- Big Data, global computing power at low prices – the world presented by almost endless analytical understanding, computation power and continuously and effectively improving cost of it, businesses can better understand their customers and effectively prevent fraud.
- Human communication technologies – technologies, which communicate with people and vice versa by much more human, more natural.
- Future system of payment – no cash, all transactions in electronic form, which helps companies to increase efficiency of payments and customers increase comfort and safety.
- 3D printing; cloud computing, process modelling, analysis of social networks, etc.

The future informatics education should be more oriented to ICT services than hardware (HW) or software (SW) components. The typical areas of education, as computer HW and SW should be innovated to education areas more connected with the digital transformation of the companies and organizations. For example, explanation the concept Industry 4.0 and themes as machine learning, Blockchain, and RFID/NFC technology. The cyber security should be educated in the broader context of the actual cyber threats as ransomware, phishing, and social

engineering. They enabled teachers to upload content and provide mechanisms for students to communicate and collaborate via tools such as forums, blogs and wikis. As a teacher we are dealing with problem how effective teach/educate the future economists and managers – advanced users of business informatics, ICT and information systems (IS). [9]

3. RESEARCH PROBLEMS FORMULATION

If our goal is individualization in teaching, respecting individual particularities of students, we have to make an analysis whether students and teachers in tertiary education are adequately prepared to master education in a competitive academic environment. As educators, we feel the need to comment on this situation. That is why we focused on real ICT skills and knowledge of our students – future advanced users, economists and managers in our research. The important queries of our research are: What is the students' knowledge base gained during their past education in the field of computer science/informatics? How can they use their information and skills? The aim of the analysis is not only to determine the precise results, but especially to reveal the reasons mutual respect and dependence potential trends so that in the future, managed to reduce the percentage of negative results. As a very important step in determining the content and method of teaching we consider an evaluation of the knowledge base of students who enter the first year at our faculty. An evaluation of students' abilities and competencies to use their information for transforming them to knowledge we consider to be a very important step in determining the content and method of our effective teaching.

For analysis processing, we have determined the two hypotheses: Is the true that the number of entering students in bachelor level at FaME is declining? Is valid the opinion that the readiness of high school graduates in informatics is growing? Both hypotheses respect the FaME representatives view, presented at the semester teaching staff meetings. Another question that interested us, is whether future economists and managers are properly prepared to the competitive environment of higher education. That is why in the first seminar students – secondary school graduates, fill in questionnaires which are focused on their general knowledge of informatics/computer science and their real problem solving skills. The eCourse has a module structure and consists of 10 blocks with LMS Moodle:

- Introduction: pretest (diagnostic test) contains 40 opened questions related to ICT.
- Thematic modules: with self-retests, syllabi of lectures, exercises and assignments for self-study study materials, block of tasks, and verification of information, important dates, and interactive communication teacher with students. Each module contains some self-retests and solved tasks related to ICT.
- Summary: exam test and final questionnaire. Final test contains students' project, practical tasks and 40 closed questions from a particular level of educational aims.

The introductory test detects the status of students' knowledge in the field of ICT) at the start of the study. Students who achieve the outcome grade A-C gain acknowledgment of the course. The summary of research results confirms the authors' estimation that about 40% of students in the subject failed. The analysis was carried out separately for distance and full-time students. The requirements at the outcome studies are indeed the same.

4. RESULTS OF ANALYSIS

This chapter contains the results of the analysis of the input assumptions and results achieved in the subject Informatics for Economists, for the period 2012-2017 in distance study (DS) and full-time (FT) study at FaME. Requirements for input and output for each form of study in the

subject Informatics for Economists are the same. The differences between the two study forms consist in different time allocations of lectures and consultations during the semester, lack of exercise in the distance studies. Any form of study has a separate eLearning course in LMS Moodle with self-tests, syllabi of lectures, exercises and assignments for self-study. The full-time students hand in the exercise tasks. For the distance studies, the tasks for exercises are available at the TBU, Study portal in Zlín. [10].

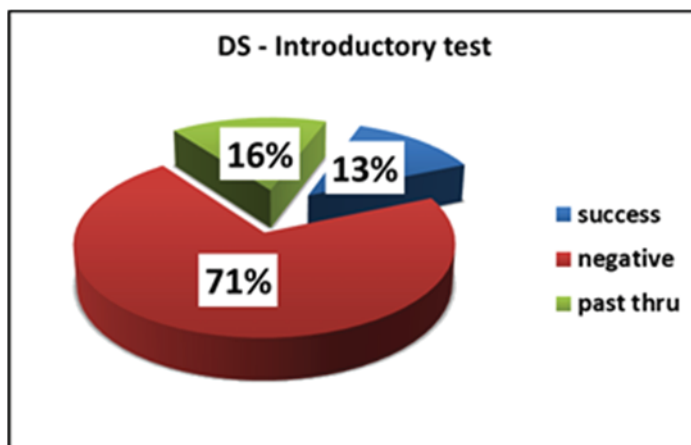
4.1 Distance study – input assumptions

The summary results of the distance students in the introductory test, detecting the entering skills and their qualifications to study informatics, are shown in Table 1 and in Figure 1.

Results	2012-13		2013-14		2014-15		2015-16		2016-17		Summary	
	num	%	num	%	num	%	num	%	num	%	num	%
Grade A	4	2,7	4	2,5	5	2,7	5	3,0	9	4,6	27	3,2
Grade B	11	7,4	7	4,4	6	3,2	8	4,8	10	5,2	42	4,9
Grade C	15	10,1	5	3,2	9	4,8	5	3,0	9	4,6	43	5,0
Grade D	9	6,0	9	5,7	13	6,9	16	9,6	13	6,7	60	7,0
Grade E	14	9,4	13	8,2	17	9,0	13	7,8	17	8,8	74	8,6
F-Failed	40	26,8	58	36,7	66	35,1	58	34,7	64	33,0	286	33,4
Unpresent	56	37,6	62	39,2	72	38,3	62	37,1	72	37,1	324	37,9
Summary	149	100,0	158	100,0	188	100,0	167	100,0	194	100,0	856	100,0
Success	30	20,1	16	10,1	20	10,6	18	10,8	28	14,4	112	13,1
Negative	96	64,4	120	75,9	138	73,4	120	71,9	136	70,1	610	71,3
Past thru	23	15,4	22	13,9	30	16,0	29	17,4	30	15,5	134	15,7

Table 1: Distance study – Results of the introductory test.

Source: own elaboration.



Note on Figure 1:
 Success = grade A, B, C,
 Negative = F and absent,
 Past thru = grade D, E

Figure 1: Summary of DS introductory test. Source: own

Survey of number DS students admitted to study at FaME in the years 2012 – 2017 shows Figure 2. The detailed results of DS students in the introductory test are shown in Figure 3.

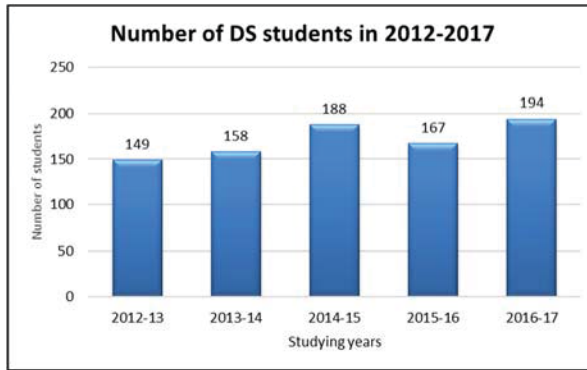


Figure 2: Survey of number distance students. Authors' own.

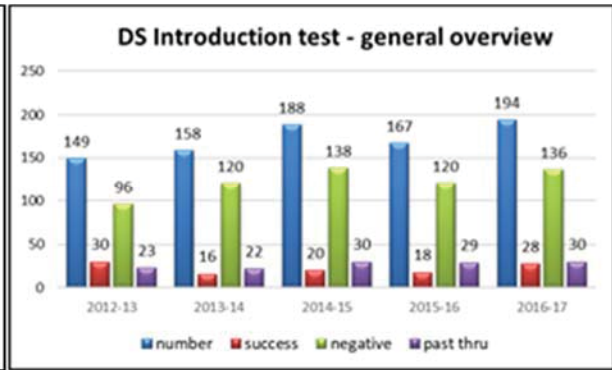


Figure 3: Introductory test. Results: Source of DS students. Source: Authors' own

4.2 Distance study – overview of study results

The general overview and summary results of DS in the subject Informatics for Economists are shown in Tab. 2. Total overview of the success DS students is shown in Figure 4; the detailed results of DS in the study years 2012 to 2017 are shown in Figure 5.

Results	2012-13		2013-14		2014-15		2015-16		2016-17		Summary	
	num	%	num	%	num	%	num	%	num	%	num	%
Grade A	9	6,0	7	4,4	14	7,4	4	2,4	12	6,2	46	5,4
Grade B	10	6,7	13	8,2	33	17,6	23	13,8	34	17,5	113	13,2
Grade C	25	16,8	21	13,3	37	19,7	28	16,8	32	16,5	143	16,7
Grade D	16	10,7	14	8,9	14	7,4	15	9,0	19	9,8	78	9,1
Grade E	3	2,0	5	3,2	5	2,7	8	4,8	5	2,6	26	3,0
Grade F	2	1,3	10	6,3	2	1,1	12	7,2	19	9,8	45	5,3
Non-admission to the exam	84	56,4	88	55,7	83	44,1	77	46,1	73	37,6	405	47,3
Summary	149	100,0	158	100,0	188	100,0	167	100,0	194	100,0	856	100,0
Past thru	63	42,3	60	38,0	103	54,8	78	46,7	102	52,6	406	47,4
Failed	86	57,7	98	62,0	85	45,2	89	53,3	92	47,4	450	52,6

Table 2: Overview of final assessment of distance study students. Source: Own elaboration

Results of the analysis confirmed that the ratio of success/failure (47/53%) of the students in education of informatics and knowledge level of DS students are surprising, even **alarming**.

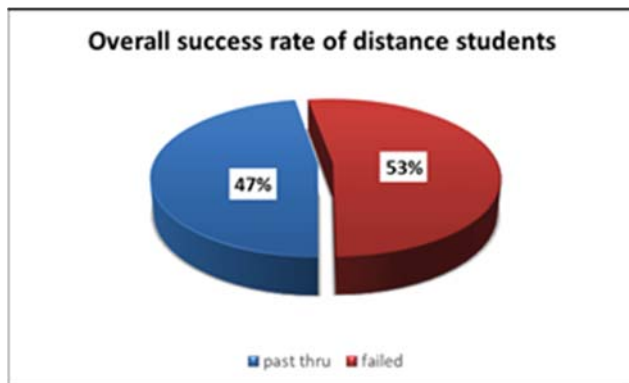


Figure 4 The overall success rate of distance students

Note on Figure 4 and 5:

Past thru = grade A to E

Number = number of the distance students

Failed = grade F and non-admission to exam (non-compliance)

Successful = grade A to E

Note on Figure 6:

Success = grade A, B, C; Negative = F

and absent; Past thru = grade D, E

Source: Authors' own.

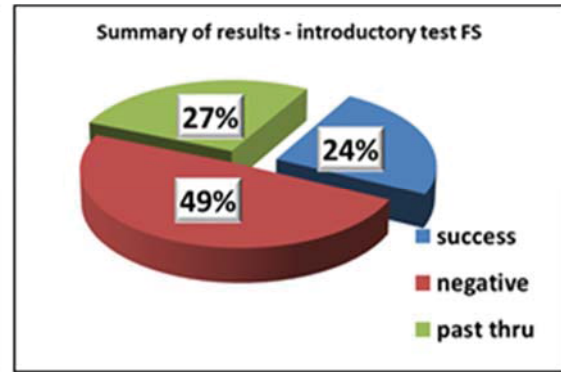
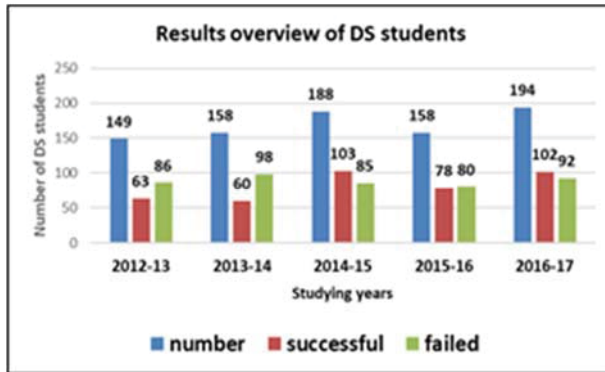


Figure 5: Overview of DS results. Source: own. Figure 6 – introductory test FS. Source: own

4.3 Full-time study, input assumption

The summary of results in the introductory test, detecting the ICT skills and qualifications to study informatics of full-time students, is shown in Table 3 and in Figure 6.

Results	2012-13		2013-14		2014-15		2015-16		2016-17		Summary	
	num	%	num	%	num	%	num	%	num	%	num	%
Grade A	18	4,5	17	4,2	28	8,5	10	3,3	23	7,5	96	5,5
Grade B	35	8,8	23	5,7	48	20,7	37	12,1	16	5,2	159	9,0
Grade C	36	9,0	24	6,0	63	19,1	32	10,5	20	6,6	175	9,9
Grade D	48	12,1	54	13,5	54	16,4	42	13,8	33	10,8	231	13,1
Grade E	74	18,6	76	19,0	34	10,3	34	11,1	25	8,2	243	13,8
F-Fail	161	40,5	178	44,4	78	14,9	111	36,4	127	41,6	655	37,2
Unpresent	26	6,5	29	7,2	32	10,0	54	17,7	61	20,0	202	11,5
Summary	398	100,0	401	100,0	337	100,0	320	104,9	305	100,0	1761	100,0
Success	89	22,4	64	16,0	139	41,2	79	24,7	59	19,3	430	24,4
Negative	187	47,0	207	51,6	110	32,6	165	51,6	188	61,6	857	48,7
Past thru	122	30,7	130	32,4	88	26,1	76	23,8	58	19,0	474	26,9

Table 3: Results of the introductory test – full-time study.

Source: Own elaboration.

Survey of number full-time students admitted to study at FaME in the years 2012 - 2017 shows in Figure 7. The overview results of FS students in the introductory test is shown in Figure 8.

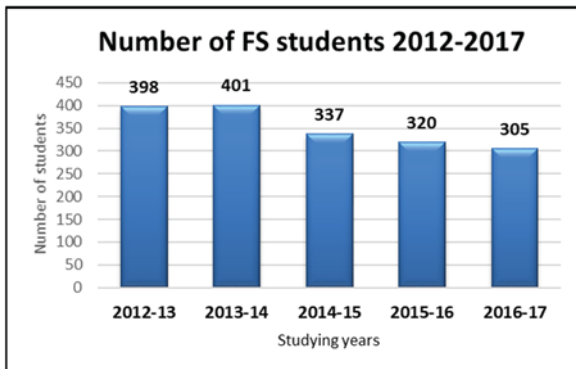


Figure 7: Survey of number FS students.
Source: Authors' own

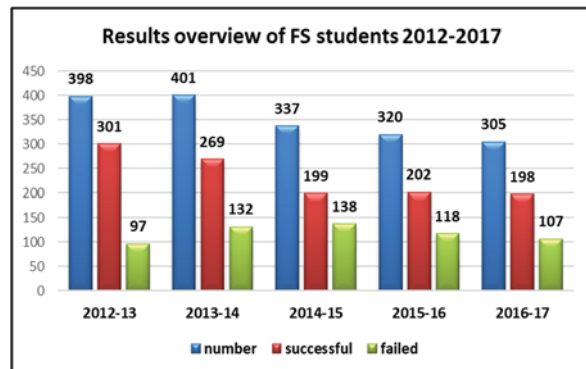


Figure 8: Results overview of FS introductory test.
Source: Authors' own

The result of analysis confirms also the conclusion that the preparation of full-time (FS) students (49%) is not satisfactory for successful completion of the course Informatics at the university (see Figure 6). In particular, it lacks of solid theoretical foundations of informatics, there is lack of knowledge of ICT in preparation at the secondary level. In demonstrating practical skills while students usually do not have problems, problems mainly occur in the absence of theoretical knowledge.

4.4 Full-time Study – Results of Evaluation

The summary study results of full-time students in the subject Informatics for Economists are shown in Table. 4. The total overview of the success FS students is shown in Figure 9; the detailed results of DS in the years 2012 to 2017 shown in Figure 10. Results of analysis FS students confirm that the level of knowledge of informatics, as well as the resulting success (72%) is significantly better than by DS students (52%). Explanation can be found in better input assumptions for the study and also grant more hours on the subject.

Results	2012-13		2013-14		2014-15		2015-16		2016-17		Summary	
	num	%	num	%	num	%	num	%	num	%	num	%
Grade A	42	10,6	20	5,0	28	8,3	10	3,1	13	4,3	113	6,4
Grade B	53	13,3	39	9,7	68	20,2	34	10,6	52	17,0	246	14,0
Grade C	78	19,6	77	19,2	55	16,3	78	24,4	57	18,7	345	19,6
Grade D	87	21,9	87	21,7	35	10,4	60	18,8	42	13,8	311	17,7
Grade E	41	10,3	46	11,5	13	3,9	20	6,3	34	11,1	154	8,7
Grade F	37	9,3	38	9,5	41	12,2	40	12,5	15	4,9	171	9,7
Non-admission	60	15,1	94	23,4	97	28,8	78	24,4	92	30,2	421	23,9
Summary	398	100,0	401	100,0	337	100,0	320	100,0	305	100,0	1761	100,0
Past thru	301	75,6	269	67,1	199	59,1	202	63,1	198	64,9	1169	66,4
Failed	97	24,4	132	32,9	138	40,9	118	36,9	107	35,1	592	33,6

Table 4: The overview of the final assessment of full-time students. Source: Authors' own

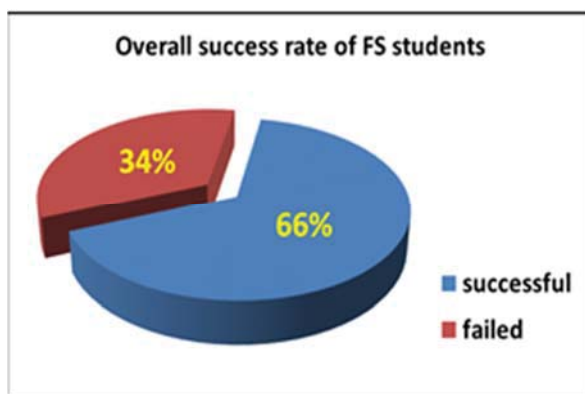


Figure 9: The overall success rate of FS.

Source: Authors' own

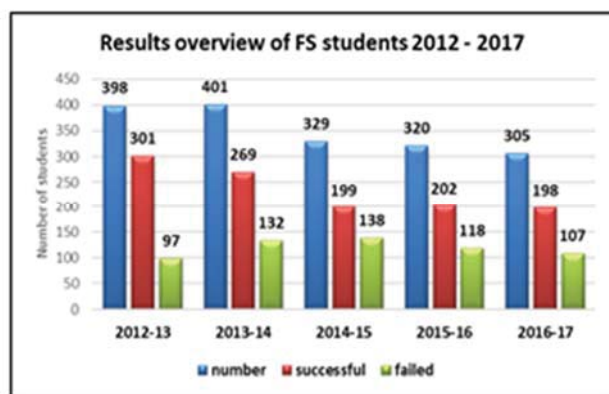


Figure 10: FS students – General overview

Source: Authors' own

Note on Figure 9: Number = number of the DS students; Successful = grade A to E; Failed = grade F and non-admission exam (non-compliance)

As shown in our research, number of accepted distance students to enroll in the analyzed period 2012 – 2017 fluctuated between 150 and 200; after declining in the second and third year of analysis, growth occurs again. The number of accepted FS students in the analysed period gradually decreases from the initial 400 to current 305 students in both forms of study of the 1st year at FaME. Decrease in this number shows up last year analysis. The total number of students in both forms of the reporting period 2012 to 2017 fluctuates between 560 to current 499 students; this means that generally maintains roughly constant condition in the total number of students received the both forms. The input assumptions for the study of the subject do not meet the 71% of the DS students (see Figure 1) and 49% of full-time students (see Figure 6).

The final results of distance students express the ratio of **47/53 %** (success/failure) see Figure 4. The results full-time students express the ratio of **66/34 %** (success/failure) see Figure 9.

The result of analysis confirms the conclusion that the vast majority of distance students (51%) haven't the requisite knowledge and therefore does not meet the requirements for successful completion of the course Informatics, without attending at the course at the university. The results of our analysis confirm also the conclusion that the preparation of the distance students (71%) and of full-time students (49%) is not satisfactory for successful completion of the course Informatics at our faculty.

6. CONCLUSION

Observation and findings during the pedagogical experiment brought ideas for further development and practical improvement of the course. Regarding the evaluation of hypotheses, both must be rejected. The numbers of student intake at FaME although fluctuating, but the declining trend is not confirmed. But it is not statistically detected. It can draw a clear conclusion that the FS students have better results that respects a totally different (better) condition for studying. It can be also concluded that the FS students are better prepared to study at a university in terms of ICT skills. The analysis confirmed the need to correct the established ideas and clichés that appear by ratings and studies of the course. An honest analysis of the data obtained is the best answer to the myths about the status and quality of studies students of our universities. Although the results are only one faculty, but it can be inferred that the other Czech universities are not doing otherwise. The analysis of the research results in makes it possible to suggest options for further development of the course in fields' informatics, ICT and IS. In no

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case is such that it could be taught computer science at FaME canceled. Why it is necessary to provide all students – future economists and managers, as advanced users with proper education in the field of informatics, IS and ICT competences? The answer can be found in the text of this paper, in the articles [7], [9] and e. g. in sources [11], [12].

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