# Working experience and programming language knowledge of university students at Alba Regia Technical Faculty

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*Abstract—* **Working experience of university students might have crucial importance in later successful career. The huge market demand for experts in informatics and students in informatics create a special human resource environment. While the players at industry try to find university students in informatics, students are in dire need to establish practical and industrial knowledge.**
**The aim of the present study was to assess data on working experience in full time university students at Institute of Engineering, Alba Regia Technical Faculty, Obuda University, and to relate it with programming language knowledge.**
**A self-reported questionnaire was assessed in 173 students from the 193 full time and active students. Data collection was taken place in May, 2016. Sociodemographic data, programming language knowledge, foreign language knowledge, working experience and study progress information were assessed. Statistica 7.0 software package was used to analyze the data, with the help a General Linear Model. For the present analysis, dual training students (obligatory professional job experience from the beginning of their studies) were excluded, thus the data of 155 students were presented.**
**Earlier or current job was present in the case of 109 students (70.32%), 81 students had current job (52.26%), while 55 students (35.48%) had an actual job related with technical higher education. Programming language knowledge was significantly higher in students with professional job experience (p<0.05). Significant positive correlation occurred between professional technical English language knowledge and programming language knowledge (Spearman R= 0.31, p<0.0001). Students with current job report a marked development in their soft skills (communication, presentation skills, decision making, creativity) and their technical knowledge as well.**
**The interpretation of the above data might be crucial in further establishment of the dual training system.**

**Keywords: Higher education, Informatics, Programming language, University student, Working experience.**

## I. INTRODUCTION

### A. *Working experience of university students*

Working experience of university students might have crucial importance in their successful career [1,2]. After graduation, ex-students have to face with the expectations of the job market. Additional to the technical knowledge, working experience and a series of skills are expected at the workplace: flexibility, working alone and in groups, decision making, presentation and communication skills [3-5]. On one hand, regular university studies are not capable providing these kind of experience, and even up-to-date technical knowledge can be found at fast-developing industrial partners instead of the universities. Thus, students are in dire need for having practical industrial air around them. On the other hand, high-tech industrial partners have a continuous problem with the replacement/restructuring of the technical human resources, and graduates in engineering and informatics are among the most successful new job seekers [6-8]. Thus, working as student of a technical university has two driving force, one from the motivational individual surface as successful early career move, and a continuous need at the level of companies for technical newcomers.

As a partial and organized solution to the above question, the dual training system have been introduced to the technical higher education in general, and also to the Hungarian technical higher education system. Dual students have double burden from the very beginning of their studies: additional to the regular university curricula, an official and continuous expectation is also present from the industrial partner [9]. At Obuda University, the dual training was introduced in 2015, at Alba Regia Technical Faculty, in parallel with other Hungarian Universities. The majority of students then did not have official dual training, but a significant number of students had jobs during their university curricula.

To our best knowledge, no official database exist on the working experience of university students in Hungary in general, and at the technical higher education in particular. As a model experiment, the present study addressed the bachelor students of the Institute of Engineering, Alba

Regia Technical Faculty. In the year 2015/16, the faculty had bachelor student in electrical engineering, engineering informatics and technical management. Additional to the working experience, factors related with working and job-seeking behavior were also considered, as motivation, language skills and importantly, programming language knowledge. Higher programming language experience was hypothesized in students with working experience. The development of skills were also hypothesized at university students with working experience.

### B. Aims

The aim of the present study was to delineate and analyze working experience and programming language knowledge of university students at the Institute of Engineering, Alba Regia Technical Faculty. The above sample might be used as an important target in our understanding of job preferences and skills of students within technical higher education in general, and informatics related fields in particular.

## II. METHODS

The study was approved by Obuda University, Alba Regia Technical Faculty. A detailed questionnaire was assessed in 173 regular students, from the registered and active 193 students (89.64%). The detailed questionnaire was registered by one of the Authors (Z. Scherer), within a personal interview in May 2016. The questionnaire was registered via a person specific code, and the following major data groups were registered: socioeconomic background, social and extracurricular activity at the university, study progress, programming language knowledge, general foreign language knowledge, technical foreign language knowledge, earlier working experience, current working experience, current working experience related with technical higher education. Among the students, 18 students was within the dual training system. As these first year students could be considered as students with present working experience related with technical higher education from the first day of their higher education studies, their results was not included in the present analysis. Altogether, the data of 155 students was presented. Among them, 27 (17.42%) first year students, 58 (37.42%) second year students and 70 (45.16%) third year students participated in the study. The number of students of technical management was 50 (32.26%), the number of students of electrical engineering was 32 (20.64%), while the number of students of engineering informatics was 73 (47.10%). The age of the students was 22.26±1.65 years (mean±SD; between 19-27 years).

The self-reported language knowledge in major European languages were assessed, but only the data of subjective English knowledge were presented. The details of the scoring and the extensive description of the questionnaire was described in an earlier manuscript [10].

The following major programming languages were targeted: php, java, html, css, c++, delphi, visual basic (vb), c, c#, r, assembly (ass), sql, pascal, or other programming language. The subjects were binary coded according to their subjective knowledge within a particular programming language.

*Statistical analysis.* Statistica 7.0 was used to analyze datasets. Additional to the descriptive statistics, a General Linear Model (GLM) analysis was applied, where the year and different type of job experience were used as independent variable, while job experience, general English language knowledge, technical English language knowledge and programming language knowledge were used as dependent variables. Newman-Keuls tests were run in case of post-hoc comparisons. Spearman correlations were also run between programming language knowledge and English language knowledge. The level of significance was set at p=0.05.

## III. RESULTS

From the 155 students included in the analysis, earlier or current job was present in the case of 109 students (70.32%), 81 students had current job (52.26%), while 55 students (35.48%) had an actual job related with technical higher education. The working experience was highly related with the study progress: students in their later years worked in a higher proportion. In the case of earlier or current work, more than 80% of third year student had a job, while this number was below 40% in the case of students within their first year (Fig. 1, $F_{(1,152)}=11.861$, $p<0.001$). Actual job also showed similar trends, current work was reported over 60% of students within their third year (Fig. 2, $F_{(1,152)}=4.086$, $p<0.02$). Over 40% of students within their third year reported current job in relation with technical higher education (Fig. 3, $F_{(1,152)}=7.976$, $p<0.001$).

Subjective general English language knowledge was not related with the study progress ($F_{(1,152)}=2.111$, p=NS), while higher technical English language knowledge was reported in students in their later years of studies ($F_{(1,152)}=3.548$, $p<0.04$).

Among the programming language directions, C#, html and sql was in the first three places (Fig. 4). Programming language knowledge was associated with the study progress (Fig. 5, $F_{(1,152)}=6.934$, $p<0.002$).

The reported programming language knowledge was not associated with earlier or current job ($F_{(1,153)}=1.973$, p=NS), nor with current job ($F_{(1,153)}=1.569$, p=NS), but was associated with current technical job (Fig. 6, $F_{(1,153)}=6.934$, $p<0.002$).

Significant positive correlation occurred between programming language knowledge and both general English (Spearman R= 0.19, p<0.02) and technical English (Spearman R= 0.31, p<0.0001) language knowledge.
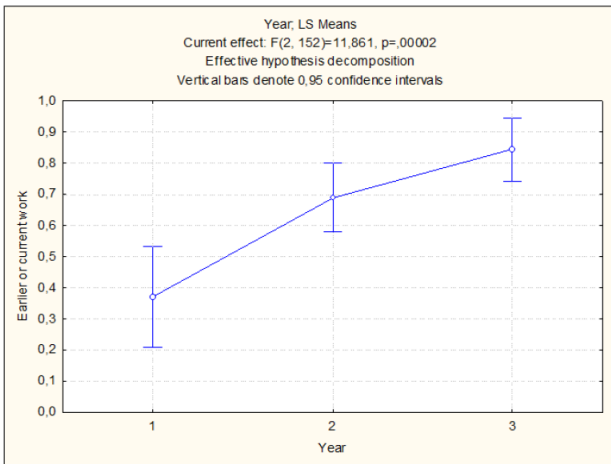
*Fig. 1. The description of earlier or current job (0.4=40%) in regular active university students (Institute of Engineering, Alba Regia Technical Faculty) during their study progress. Means and 95% confidence intervals are presented.*
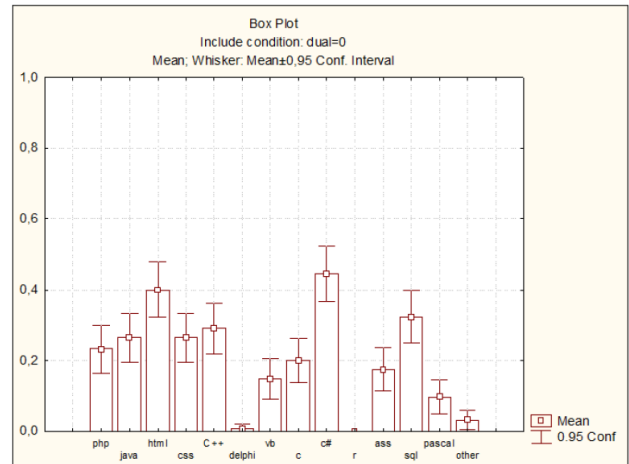


*Fig. 4. The description of different programming languages or frameworks (0.4=40%) in regular active university students. Means and 95% confidence intervals are presented.*
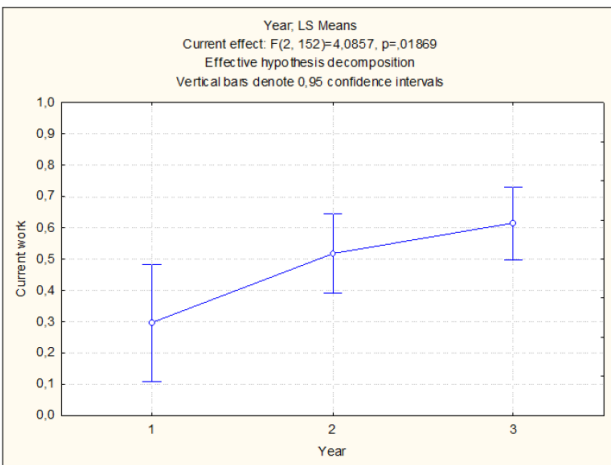


*Fig. 2. The description of current job (0.4=40%) in regular active university students (Institute of Engineering, Alba Regia Technical Faculty) during their study progress. Means and 95% confidence intervals are presented.*
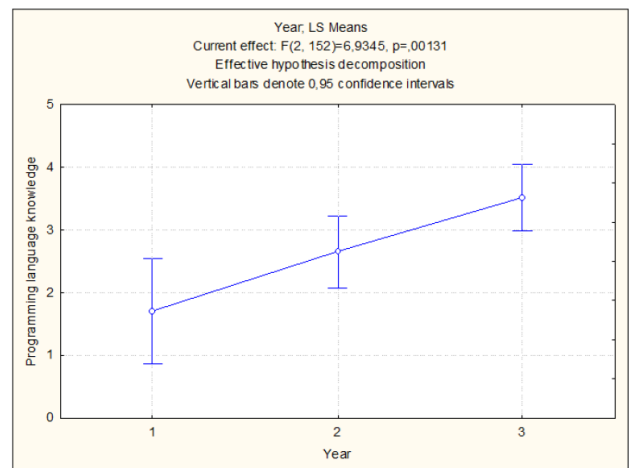


*Fig. 5. The number of subjectively reported known and used programming languages. Means and 95% confidence intervals are presented.*
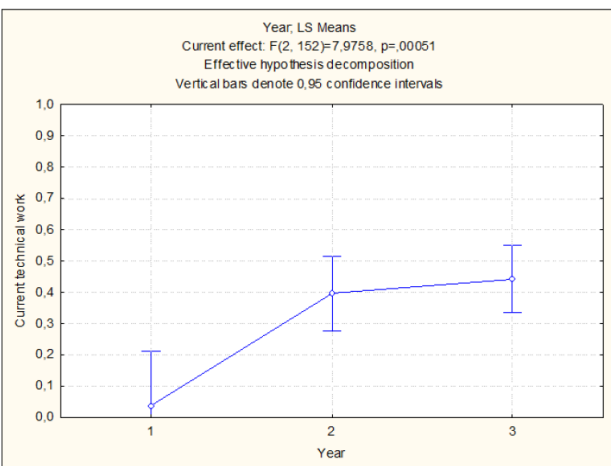


*Fig. 3. The description of current technical job (0.4=40%) in regular active university students (Institute of Engineering, Alba Regia Technical Faculty) during their study progress. Means and 95% confidence intervals are presented.*
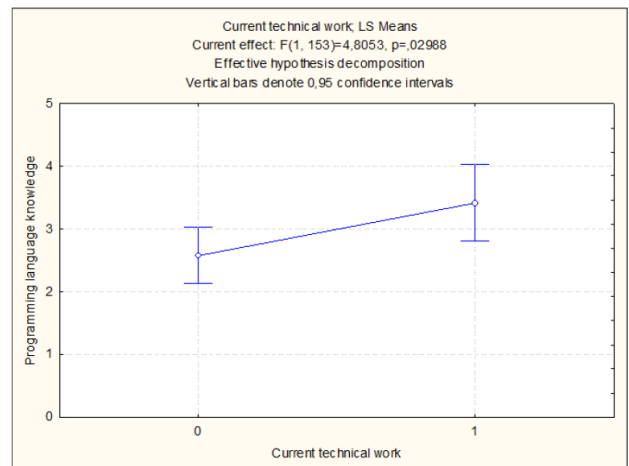


*Fig. 6. The number of subjectively reported known and used programming languages. Means and 95% confidence intervals are presented. 0= current technical work is not present; 1= current technical work is present.*

The motivation of having current technical job was associated with experience in technical knowledge (41.82%), financial reasons (34.54%), future career (16.36%), and simple possibility (9.10%). During their specific work, the development of problem solving was reported in 72.72%, communication skills in 70.10%, independent working in 43.64%, decision making skills in 41.82%, creativity in 40.00%, flexibility in 36.36%, presentation skills in 27.27%, programming skills in 21.82%.

## IV. DISCUSSION

The main results of the present study were the followings. First, job experience was associated with study progress, and the majority of the students had job experience during their studies. Second, programming language knowledge was also associated with the study progress, and current technical job experience was associated with higher programming language knowledge. Third, the students were motivated for technical jobs mainly in order to acquire technical experience, and were reporting significant development in a series of soft skills necessary for their later success.

The proportion of working experience was considerably high in the present sample, and was even higher in the original sample including the students with dual training. Still, the exclusion of the dual students was necessary for the present analysis, as their "success" at the job market was not associated with particular skills acquired at the university. Dual students have to go through a selection process, and specific basal attributes might be different from the beginning, but the authors could not find major differences within the targeted attributes at early level of their university studies [10]. However, differences in the study progress might be present even at their first year of their university studies compared with non-dual students [9].

The present study described three levels of working experience, as previous (or current) work experience, current work experience and current work experience related with technical higher education. General English knowledge was not different in the above groups, but significantly higher technical English knowledge scores were reported in students with current work experience related with technical higher education. Interestingly, similar differences were observed in reported knowledge of different programming languages, and most importantly, a significant positive correlation was observed between reported technical English language knowledge and knowledge of programming languages. This finding was not originally considered as major link between factors necessary for later success in the field of engineering and informatics [4,5].

The development of practical knowledge [3] and the specific support of soft skills [7] are indispensable for later success, and these attributes also occurred in the present study. As a major drive for job experience, the dire need of practical and technical knowledge was the most important attribute in the motivation for current technical job performance. Students with current technical work experience reported a significant development in their problem solving and communication skills in more than 70% of the cases, and a significant amount reported significant improvement in independent working decision making skills, creativity, flexibility, presentation and programming language skills. Thus, working experience in itself had a major educational power, and its optimal timing and effective intensity should also be reconsidered in students within the dual training system. But, analyzing driving forces might have to include inner motivation, what is a powerful and most important drive in the education of engineering and informatics [11].

The limitations of the study were the followings. Only 155 students were considered in the present analysis, thus further longitudinal and even cross-sectional data collection would be indispensable for high level interpretation. On the other hand, the above sample was representative in the case of Institute of Engineering at Alba Regia Technical Faculty, thus within this context, these data might be interpreted. Other limitation of the study is the self-report of foreign language knowledge and programming language knowledge, additional to the reported development of the soft-skills. These measures can be assessed in a more objective evaluation process, albeit standardized procedures for the interpretation of the above measures in soft skills are still lacking from the literature. In future studies, these issues also should be addressed.

## V. SUMMARY

In the present paper, working experience of undergraduate students at Alba Regia Technical Faculty was assessed and interpreted. Current job related with technical higher education was associated with more extensive programming language knowledge. Students with current job report a marked development in their soft skills (communication, presentation skills, decision making, creativity) and the development of technical knowledge as well.

## VI. ACKNOWLEDGMENT

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