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Reflective practice – an objective of the career counselling and orientation process

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Abstract. The correlation of theory with practice in the educational process, materialized in various forms, one of which being the professional practice, brings with it a series of benefits for the students: from verifying and validating the knowledge to covering all the learning styles of students. It is also an important milestone in guiding student careers by facilitating reflexive approaches, with a significant contribution to the crystallization of the professional route. Having the study case as a central research method, this paper highlights the mentioned benefits of the professional practice. The sample consist of 100 respondents (students in the 3rd year of study), data processing being done in SPSS 20.

1 Introduction

Formal education proves its effectiveness to the extent it enables a fast and successful integration on the job market. This means, on the one hand, that a young graduate might find a job related to his/her expertise that implied time, effort and hope, and on the other hand, to prove that he/she has such social skills that enables his/her integration in the organizational culture of that job (a critical condition for a good work efficiency and maintaining stress and work anxiety under control). There are several factors whose implementation may facilitate the coagulation around this standard of effectiveness of formal-type education, among which, one of maximum impact, the impact of correlating theory with practice. Based on the cognitive structuralism theory [1] which promotes the proactive-practical way of learning by discovering, the principle of relating theory with practice (actually, one of the major principles governing academic activity) reconsiders the sense and purpose of learning, i.e. knowledge by understanding, for application, adaptation and progress. The orientation towards combining theory with practice in the teaching/learning process allows the valorisation and coverage of all the learning styles of the beneficiaries of education acquiring besides the theoretical component, that of the proactive, reflective-pragmatic one. One of the variants of implementation of this principle at the level of higher education involves the correlation of the educational offer of the university with the job offer on the market, which implies a dialogue between universities and companies-institutions (e.g.: Ministry of Labour,

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Ministry of Education, ANOFM- The National Employment Agency etc.) responsible for welfare and quality of life. Economic growth and employment measures within the knowledge society, as set out in the Lisbon Strategy (adopted by the European Council in 2000 and implemented in three cycles until 2013) [2] which proved to be successful but also poorly implemented, are pursued in Europe 2020 strategy, whose European objectives are transposed into national objectives. The Sectorial Operational Program for Human Resources Development 2007-2013 (POSDRU) financed by the European Union through the Structural Instruments, namely the European Social Fund [3], has as a general objective "to develop human capital and increase its competitiveness by connecting education and learning throughout life with the labour market and ensuring increased participation in a modern, flexible and inclusive labour market for 1.650.000 people" [4].

University POLITEHNICA of Bucharest (UPB) is one of the oldest and reputable schools for engineers in Romania, with a considerable experience in technical training. UPB mission is to train engineers according to the modern principle of direct participation in choosing his/her formative course, including in a learning process which might assure him/her real chances on the free job market, such engineers who might have economic and managerial knowledge and be capable of adapting to the requirements of market economy and to the new technologies. Moreover, UPB has a wide experience in project management, having participated as a lead partner and a partner, in over 60 POSDRU and OS CCE projects [5] POSDRU/161/2.1/G/136211 project, „A successful career in engineering sciences", conducted by UPB, the Faculty of Engineering and Management of Technological Systems (IMST), was carried out under the priority axis 2 concerning „Correlation of long-life learning with the job market", major domain of intervention 2.1 „Transition from school to active life", with the purpose of facilitating the shift from the student to employee status. The above-mentioned project aimed at the achievement of the European Social Fund objectives (while also aligned to the priorities of 2020 Strategy) [6] i.e.: getting aware of the real competences needs of the graduates reducing the differences between the knowledge acquired in the academic system and the employers' requirements, enhancing sustainable economic growth using smart networks and digital economy, a better training of the young people [7] for the job market and equality of chances. The overall objective of the above-mentioned project, of assuring the transition of 400 students (per project) from Bucharest-Ilfov area to the job market, was attained by a few specific objectives materialized in two major activities: (1) professional counselling and orientation of the undergraduates in order to develop a career and to be aware of their rights and obligations as employees; (2) professional internships for the correlation of the skills and competences acquired by the undergraduates by means of higher education with the employers' expectations. The project benefitted at the same time from an online platform, for the dissemination of the project results and providing online support to undergraduates.

2 Methodology of research

This paper aims at highlighting the fact that professional counselling and orientation services provided for the undergraduates enable their development and manifestation of a reflexive attitude on practical academic education, beneficial for facilitating the transition to the job market.

The central research method selected for the verification of our theory mentioned above as the purpose of our research, is the case study, because „it develops a situation where we can notice the game of a large number of factors interacting, allowing to recognize the complexity and richness of social situations and explanation of the relationships which are too complex for survey or experimental strategies" [8]. The case is understood as an integrated system, holistically approached, as the researcher is interested more in 'how' and

not 'why' the phenomenon under study (a person, a community, an institution) presents itself in a certain way. In our paper, we use a case study of instrumental interest (it aims at verifying a theory, this particular case being of secondary interest), of qualitative type (because we use qualitative methods – the questionnaire and social document-based interview). On the other hand, when drafting this case study, we used the question-answer type format (consisting in the presentation of questions that the researcher asked himself/herself and the answers he/she got) with a compositional structure in suspense, which means that „the laniary-analytical structure is inverted: conclusion – the result of the case study – is presented at the beginning of the research report, the following chapters developing the reasoning, the explanations" [9].

In order to get answers to our questions raised during the case study and which contributed to the validation of our theory as a final result and conclusion of this investigation, we used the study of social documents and the structured interview. The study of the social documents refers to those documents or official deeds which provide information and based on which a fact can be proved. The method is often used to verify and supplement the data obtained through other methods. The documents studied to reveal certain information which add to our investigation are both digital and non-digital, of public nature: the register of the project target group, the assessment reports of the beneficiaries related to the internships, the web page of the project. The structured interview – based on a questionnaire, also called standardized interview, widely used in sociological and psychological research, enables the comparison of the points of view of the interviewed persons. The mini-questionnaire underlying our interview, aimed at the comparative investigation (before and after the internship) of the opinions of the beneficiaries related to the utility of the internship for their transition to the job market made out of 3 pre-codified items (because they allow the best statistical processing), but the lists of potential answers necessarily include a variant of an 'other mentions'-type of multiple choice test. Out of a total of 117 students participating in the internship, 100 responded to our investigation. We used a multistage stratified sampling. The multistage sampling: the first phase when the sampling unit was the faculty, then the second step, the sampling unit was specialization. Stratified sampling participants' genders are presented in tables 1 and 2.

Table 2. Participants' demographics

Age range	P1-Gender
$M_{age} = 21{,}7$ years	75% male 75% male

2.1 Case study - results

The result of this case study is that the professional counselling and orientation services (provided by means of the POSDRU/161/2.1/G/136211 project, „A successful career in engineering sciences") enabled the students to develop and manifest a reflexive stance on the practical academic-type learning process, beneficial for the awareness and realistic self-assessment of the competences and necessary for the transition to the job market and practicing the engineer profession.

We reached this conclusion by turning to good account the opinions and experiences of 100 students, as beneficiaries of the two above-mentioned projects. A total of 400 students were registered in the target group selected from the four years of studies according to a procedure which clearly set the criteria, aiming at the respect for the equality of chances and relying on the students' interest. The professional counselling and orientation activity was performed throughout the whole project, all the students belonging to the target group benefitted from the counselling support. The internships covered a three-month period out of

17 months allocated to each project, and only 3rd Year students were selected, out of 117. The recommendations of the professors and experts in professional counselling were considered in the selection and distribution of students for internships.

The answers obtained by the authors to the questions asked and which confirm the theory of this investigation, are given below.

What are the specializations in engineering of the faculty which run the project?

The webpage of the faculty shows that the three departments of the Faculty of Engineering and Management of Technological Systems of POLITEHNICA University in Bucharest provides for the following specializations of bachelor and master in the line of engineering: the Department of Machine Manufacturing Technology (specializations: Machine Manufacturing Technology, Industrial Economic Engineering, Nanotechnologies and Unconventional Systems), Department of Machines And Manufacturing Systems (specializations: Machine-tools and manufacturing systems, Robotics, Industrial Logistics), Department of Materials Technology and Welding (specializations: Engineering and quality management, Welding engineering, Engineering of industry security) [10].

How was internship designed in projects?

According to the studied documents (mentioned above), during the academic years 2014-2015, internship was completed within each mentioned project at IMST – Faculty of Engineering and Management of Technological Systems, where 3rd Year students selected from among the counselled students participated. The internship summed up 360 hours, of which 120 hours – allotted to the CAD design stage under the guidance of the internship partner 1, and 240 hours – allotted to technological internship with internship partner 2. The CAD design stage was completed under the coordination of Partner 1 - S.C. VEGRA INFO S.R.L., and the technological internship was organized under the coordination and at the head office of 27 companies in Bucharest and surrounding areas. For the completion of these stages, tripartite Internship Agreements were signed in compliance with the provisions of the project between University POLITEHNICA of Bucharest, by the IMST – Faculty of Engineering and Management of Technological Systems, the above-mentioned partners and every intern student, with the strict observance of the legal provisions mentioned above. They included also, as an appendix, internship portfolios which set the rights and assignments of the signatory parties and the competences to be acquired during the technological internship and were signed by the Dean of the Faculty of Engineering and Management of Technological Systems, the Directors of the internship partners, by every intern student and by the Internship Supervisor on behalf of University POLITEHNICA of Bucharest and the tutors designated by the internship partners, with the strict observance of the Order of the minister of education, research and youth no. 3955/2008 regarding the internship stage during the academic programs, of the specific internship rules of University POLITEHNICA of Bucharest and the laws related to labour protection.

How was the CAD internship stage carried out in the academic year 2014-2015?

The CAD design internship was carried out at the internship organiser's place - POLITEHNICA University in Bucharest, at the Faculty of Engineering and Management of Technological Systems, under the guidance of the internship partner, S.C. VEGRA INFO S.R.L. a supplier of professional services in the country and abroad (working mainly for clients in France, Germany, Holland, Belgium, UK and USA) in areas such as CAD (Computer Aided Design), 3D engineering, GIS (Geographic Information System) and CAFM (Computer Aided Facility Management). All the students selected for the internship at SC Vegra Info SRL took part in various production processes under the guidance of the company tutors, and had all the expertise and support provided for the UPB students' internship, in a key-field extremely useful to any company they will be employed with: automatic mechanical design, to build parameterized models of the components and subsets, thus covering the whole production process – from design to the finite product, according to

the internship report book. Vegra Info has a wide experience perfectly adapted to the scope of the project. Since its establishment, the company management was aware of the importance of the development of the young people (students and graduates) placing special emphasis both on the development of practical skills and on specific competences requiring high qualification. The training of these young people and co-opting them in the team provided for the company growth resources, which became a market leader in its line of business. To this day, approximately 30% of the company staff has been employed directly from the faculty.

Concerning the proceedings of internship, the students were divided into sixteen groups of 4 or 5 students each, every group was guided by a tutor designated by the internship partner. The CAD design internship, according to the internship portfolio, had to develop in students professional competences by specific activities (table 3).

Table 3. Competences resulted from the design internship

No.	Competency	Planned and carried out activities
1.	Associating knowledge, principles and methods from technical sciences of the field to graphic representations to solve specific tasks.	Initiating the use of SolidWorks and CAM Works specialized software packages, for the constructive and technological design of the products, management and/or economic analysis of the processes/ systems of production etc.
2.	Using software applications for the assisted design of products and/or the solution of tasks typical for engineering and management.	

To this purpose, throughout the 120 hours of design internship, the students were initiated and instructed by the internship tutors for the successful use, in design, the SolidWorks software. In accordance with the provisions of both projects, Partner 1 used for instruction an assisted design guide elaborated in the first part of the project, when the software applications the students worked with were defined (e.g.: automated mechanical design – parameterised models of the components and subsets, views in drawing, manipulation of dimensions, study of the fluid flows etc.). In the last week of internship, the students used the knowledge accumulated with the purpose of designing a part.

The internship supervisor and the internship tutors assured the planning, organization and supervision of the internship, participated in setting themes and competences and made efforts for the internship to be in compliance with the agreements and the students observe the conditions and requirements of the internship stage. At the end of the CAD design internship, the students filled in the observation sheets, which the tutors endorsed later. At the same time, the tutors filled in the Activity Reports, and then they filled in the student assessment sheets by the tutors, according to the provisions of the Procedure of assessment of the practitioner students.

How was the technological internship carried out in the academic year 2014-2015?

For 7 weeks (240 hours), the students participated in the technological internship. They watched the way in which the production activities were carried out at the internship partners 2 (27 technical companies), with which partnership agreements were signed.

The students' allotment to internship partners 2 considered the overall grade of the 2nd year of studies, the score of the general technical knowledge, the recommendations of the specialists in professional counselling activities, but also every one's options.

The professional competences to be acquired by the students after completion of the technological internship stage by carrying out specific activities, according to the internship portfolio (table 4).

Table 4. Competences resulted from the technological internship

No.	Competence	Planned and carried out activities
1.	Elaborating and interpreting the technical documentation corresponding to the technological manufacturing processes.	- Preparing the documentation for the programming, planning and monitoring the production in certain organizational structures of the company / the research institute where the internship was carried out. - Knowing, using and preparing the information necessary for the design and implementation of the technological processes by means of real and virtual processes (drawings, forms, technology sheets, operation plans, specifications, 3D models etc.) - Using certain software instruments of the internship partner for the technological design of some products or for production management - Knowing and analysing certain process projects and production system of the company/research institute where the internship is carried out: flows, locations, programs, load tracking, quality control or other specific examples.
2.	Using the software applications and the information technologies to solve tasks specific for engineering and management.	
3.	Technical and economic design and product and industrial processes improvement.	
4.	Economic evaluation, planning and conducting processes and logistic and production systems, assuring the quality of the manufactures.	

The internship program generally observed the partners' working hours, as provided by the internship agreements, within the limit of 7 hours / day. Internship was carried out under the guidance of the tutors, and the students acquired abilities for the realisation of parameterised models, of components and sets and covering the whole production process – from design to finite product, according to the internship notebooks. The internship notebooks were filled in under the guidance of the tutors, of the expert in the elaboration of the internship documentation and of the internship supervisor.

The internship supervisor, along with the internship tutors, provided for the planning, organization and supervision of the internship (by periodical visits to the internship partners) and supervised the internship to be in accordance with the commitments set out and the practitioner students observe the requirements of the internship and internship partners. At the end of the technological internship, the students completed the Observation Sheets that we forwarded, and the tutors endorsed. The tutors filled in the Reports on the activities carried out, and then they filled in the Student assessment sheets by the tutor, according to the provisions of the Procedure of practitioner students' assessment. We endorsed these assessment sheets and the students' attendance. According to the same procedure the internship was completed by a colloquium where the students presented their achievements and answered the questions of the examining board consisting of the Project Manager, the expert with the selection of the target group and the internship supervisor. The students' assessment at the colloquium was done by filling in the Internship Final Assessment Sheets by the members of the assessment board was done by filling in the Internship Final Assessment Sheets by the members of the assessment board following the consultations and was completed by drafting the Summary table of the students' results and the Ranking of the award winning students.

What is the real satisfaction of the internship beneficiaries?

The final assessment sheet aimed at observing the six criteria of assessment with different percentages of the final grade, as below (table 5):

Table 5. The internship final assessment sheet

No.	Assessment criteria	Marking points	Marked - obtained* points
1	The tutors assessment (in the CAD design internship and the technological internship)	15	14.55
2	The quality, volume and originality of the internship notebook on the description of the daily routine of their internship (of CAD and technological design)	30	28.48
3	The quality, consistency and originality of the presentation the day of the assessment	10	9.20
4	The degree of participation in internship (of CAD and technological design)	10	9.63
5	The accuracy and consistency of the project for the part received as an internship theme	15	14.73
6	The degree of acquiring professional technical and managerial skills aimed by the CAD design and technological internship stage (answers to the questions of the board)	20	18.89
TOTAL SCORE		100	100

*The arithmetic mean of the points obtained per each criterion of assessment was calculated and the answers of the 100 beneficiaries of the internship stage were centralized.

In accordance with the provisions of the project, 50% of the students who participated in the internships organized in the academic year 2014-2015 were rewarded, respectively the 2nd Year of the project, i.e. 40 students, who had special results and demonstrated the acquisition of skills expected from the internship stage.

What are the opinions of the beneficiary students in relation with the importance of internship in facilitating the transition to the job market?

Any career counselling service for the beneficiaries of education – in this case, students – must start in the design phase from the specifics of the area of study. Technical thinking and skills are dominants of the technical higher education. We find the principle of the relationship between theory and practice very well and pungently illustrated in technical education. In technology, technical thinking has specific elements: pragmatism (design for solving practical problems), intuitive-action thinking (which determines the concrete orientation into an intuitive situation and the rapid passing to action, for the quick exit from the unforeseen functional-technical difficulty), constructive-functional thinking, economic and organizational thinking [11]. The UPB students, irrespective of their major, have a pragmatic style of approaching and solving problems – it is a defining note and at the same time a particularity in choosing and browsing these studies. Yet, pragmatic thinking has efficiency and qualitative results only when accompanied by an important reflexive component (because it allows the anticipation of the problems that may occur, the identification of certain dysfunction of the technological process, it enables quality control etc.). Reflexive thinking must be supported during the academic years by all the didactic approaches, so that the main objective of the career counselling process intended for the students in the project who benefitted from professional internship, was to encourage this component in the group and individual counselling sessions. The mini-questionnaire on the importance of internship in facilitating the transition to the job market was filled in first (before starting the internship stage of the project) during the individual counselling session. This questionnaire was followed by a student-counselling expert discussion, both to debate and to clarify the contribution of the internship stage in the formation of professional competences, and to clarify other aspects related to the profession-personality concordance (and materialized in a career plan). To capture the impact of internship, we applied this mini-

questionnaire on completion of the internship stage, and the results were as below (tables 6, 7, 8).

Table 6. Importance of participation in the internship stage to get a job

How important do you think that the participation in these internship stages of the project to get a job?	Very little importance		Little importance		Average importance		Important enough		Very important	
	A*	B*	A	B	A	B	A	B	A	B
	0%	0%	8.4%	0 %	28.2	2.2 %	20%	21.3 %	43.4 %	76.5%

*A= Before starting the internship stage; B= After completion of the internship.

The students were aware of the benefits of professional internship as very important (43.4% before internship – 76.5% after internship) during the studies: overcoming the impediment of the lack of work experience on employment of the debutant, verifying the type of work and appropriate work environment and an objective feedback related to the level of acquired competences.

Table 7. Considerations of the theoretical training received during the academic years for the specialized field

How do you assess the theoretical training you get during academic years, for your area of expertise?	Very little importance		Little importance		Average importance		Important enough		Very important	
	A*	B*	A	B	A	B	A	B	A	B
	0%	0%	26.6%	4%	33%	5.3%	31.9%	31.4%	8.5%	58.8%

*A= Before starting the internship stage; B= After completion of the internship.

The opportunity of performing practical activities in the specific field enabled a better valuing of the theoretical component taught in the faculty. Thus, the students found a lot of theoretical information acquired during the courses as essential conditions for the application of the technological process. The re-signification of the theoretical component at the level of the meaning and utility is considerable in this context (from 8.5% very important before starting internship to 58.8% very important after completion of professional internship).

Table 8. Relevance of practical training obtained during academic years for the specialized field

How do you assess the practical training you received during academic years for your area of expertise?	Very little importance		Little importance		Average importance		Important enough		Very important	
	A*	B*	A	B	A	B	A	B	A	B
	0%	0%	8%	2.3 %	66 %	73%	21 %	8%	5%	3.7%

*A= Before starting the internship stage; B= After completion of the internship.

The question aimed at the students' assessment of the quality of practical training through academic studies, except for the internship opportunity in the project. Turning to good account this essential component to train the engineer as average importance refers less to the quality of the activity itself but rather to the fact that, in the students' opinion, it is achieved insufficiently in point of frequency.

3 Interpretations

Carrying out the project internship enabled from the didactic point of view the correlation of theory with practice, and from the point of view of the professional counselling process, encouraging reflexive thinking – considered as the second nature of the engineer's pragmatic thinking. The cognitive-reflexive approach of the investigated students facilitated by the professional counselling sessions resulted in the following remarks:

Orientation to jobs in the line of design engineering – the students find this field more appropriate, the production work comes second.

Need to cover several disciplines of the academic curriculum design type, in their opinion, the competences acquired in this area of expertise provide higher chances of employment and integration on the current labour market.

Extension of internship opportunities similar to those in the project, at the level of all the academic years (not only on the 3rd Year).

Interest in revising certain theoretical knowledge taught in the previous years with major disciplines for the formation of engineering bases, through the practical activities carried out.

4 Conclusions

The data obtained and the students' remarks as a part of supporting the cognitive-reflexive approach during the counselling session reveal the various hypostases in the learning process provided by turning to good account the relationship between theory and practice in the teaching/learning process, i.e. the application of certain theoretical knowledge to solve certain tasks – a preparatory exercise to solve the future tasks specific for the work place – and internship – valued as starting point in learning by discovering, collaboration and research.

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