

Career Socialization of Engineers and Architects
During Academic Training and After graduation

(A study of curriculum, personal development and labor market related aspects of career socialization among the students and recent graduates of a college of engineering in Hungary)

Doctoral thesis

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1. Background, aims, focus and method of research

In the dissertation related literature has been reviewed along a web of key concepts in order to synthesize and reveal crucial convergences. *Career socialization* is a very important phase of the individual's integration into society (Ritoókné 1994, Super, D. E. 1994, Rókusfalvy 1994, Szilágyi, J. 1986), in which process education plays a key role. Before 1989 it was widely assumed that the essential conditions of career socialization were fulfilled if education met the career mirror.

Political transformation in 1989-1990 and joining the European Union demand that Hungarian educational policy adapt, follow and change already existing European patterns (Biszterszky 1994, Darvas 1993).

Under these circumstances the role of human resources in the process of production has gained increasing value, yet the economic return of the investment into the development of such resources has been fiercely debated (Schulz, 1983, Robinson-Fuller, Tanítani ... 1996, Oktatás - rejtett kincs 1997). Research in Hungary has clearly proved that education and professional training also face this dilemma as well as that the personal element and knowledge must be increasingly incorporated into the up-to-date economy of the future (Sallay 1996, Új képzési modell 1996, Hideg-Nováky 1996).

Education, professional training and human resource management

are based on the yet vaguely defined concept of *competence*. Competence justifies the aptitude of a person or community to complete a specific task in a given situation; moreover, it projects the transfer of this accomplishment under similar circumstances as predicted value (Jean-Pierre Bellier 1998).

Engineer teacher education can only meet the demands and constraints rooted in the profoundly and radically changed social - economic environment and political trends of the country if an orientation toward teacher competences determines the concept of its curricula. It also needs to be integrated into the comparative study of European engineer teacher education (Tóth 1994, 1999).

Unfortunately in the last fifteen years no comprehensive empirical studies have been conducted or major publications issued that provide a detailed picture of the career socialization of engineer- and architect trainees. The present research aimed to explore, describe and discuss factual data in this field.

Regarding the peculiarities of four-year college-level engineer and architect training the study focuses on *three major fields*:

1. Curricula, which as the basic documents of education determine the most significant stages of the given period in career socialization
2. Major tendencies in personality development during the years of academic training
3. Formation of career socialization status in the case of recent engineer and architect graduates (earning their degrees within the last 1-2 years).

Exploring these three fields we used different methods. While carrying out the studies our aim was to explore processes and tendencies rather than to record momentary conditions. In the case of curricula we applied the method of document analysis, which was later supplemented with techniques of document restoration. As far as personality assessment is concerned we applied psychological tests and statistical analysis. Techniques of official inquiry and statistical analysis were used to map socialization after graduation. We intended to justify our hypotheses based on twenty years of experience in college-level technical education.

2. Hypotheses

1. As regards educating young technical intelligentsia in the South Transdanubian region University of Pécs, Pollack Mihály College of Engineering is a school of fundamental significance in part because of its intellectual attraction and regional monopolistic position.
2. In accordance with the present social-economic situation our faculty may contribute to the successful career socialization of the new generation of technical intelligentsia in two ways. Firstly, it caters for gaining up-to-date professional knowledge

and attitude in engineering and architecture; secondly, it helps acquire middle class communicational, attitude and value culture. At the end of the 1990's professional training still overwhelmed the importance of general knowledge courses at our college.

3. The majority of students at the University of Pécs, Pollack Mihály College of Engineering are not entirely familiar with middle class communicational, attitude and value culture. A significant number of our graduates become part of the intelligentsia lacking apparent general knowledge concerning communication and attitudes. It is also closely related to the fact that the personal maturity of our graduates lags behind age expectations.
4. Although the academic results of our students slowly improved in the last thirty years (due to the joint efforts of students and instructors) some fields of the training have yet their problems. Problems related to teaching and studying derive from the variance of applicant groups.
5. Even being aware of these problems we assume that by their graduation our students acquire enough professional knowledge so that the professional of engineering and architecture acknowledge their expertise. Moreover, they are satisfied with their training.
6. The quick and peaceful social transformation at the end of the 1980's immediately affected our graduates because the meaning of the concept "finding employment" changed profoundly. *Individual ability to hold one's ground at the labor-market* replaced the previous system of distribution. College training prepared students for such competition only from the professional side.
7. Despite new social expectations and the nature of present training the career socialization of recent graduates from the University of Pécs, Pollack Mihály College of Engineering is still satisfactory. Time has come, however, that reducing the quality-related deficiencies of technical training as well as the quality- and quantity-related deficiencies of general higher education cannot be delayed any further without risking successful engineer and architect career socialization.

To justify these hypotheses we will analyze the curricula of the University of Pécs, Pollack Mihály College of Engineering, survey the career socialization of our recent graduates as well as their views about their academic education and carry out the personality assessment of students.

3. The role of curricula in career socialization

Curriculum development as a way to implement career socialization is certainly worth of interest. In our study we intended to look at all the curricula used at the college in the past, however, a lack of availability we had to deal with timetables. If timetables could not be accessed we had to restore those on the basis of

register books.

Subjects in the timetables could be arranged into subject-blocks. The number of classes within a subject-block well reflected the significance attached to the given field of study. Subject blocks were established on the basis of the graduation requirements (achievement targets toward earning the degree). Accordingly we distinguished: a) basic knowledge in sciences, b) subjects related to economy and humanities, c) main professional knowledge, d) degree-specific professional knowledge.

Class time devoted to each subject block proved to be a suitable scale that expressed the institutional ideas concerning the given period of career socialization. The timetables that we found and the ones that had to be restored show that college policy regarded the highest possible number of classes in the fields of main professional knowledge and degree-related professional knowledge practically the only way to implement career socialization. Preparing students for life as members of the intelligentsia was not found important.

Academic achievements in mathematics played a key role in shaping the subject block on sciences. From the perspective of career socialization it mainly works as potential source of disqualifying students, which at times may even question the survival of the entire training course.

Multifarious goals characterized the subjects related to economy and humanities. Due to certain political pressure the number of classes had been increased at one time. In the wake of political transformation its content practically lost meaning. Its new purpose could be human resource development, which, despite its obvious significance in career orientation, can hardly gain space and status in four-year college-level technical education. The content of subjects related to main professional knowledge and degree-specific professional knowledge were continuously renewed mainly in order to maintain and improve the quality of education, which also served to ensure the purposes of career socialization and quality control. Ever since its foundation the college aimed to ensure the quality of education by increasing the number of classes in subjects related to professional knowledge. This policy intended to achieve career socialization by means of strengthening the *professional training function* of the program, thus the *function to help become part of the intelligentsia* was reduced to a formal level.

4. Career socialization of recent graduates

Looking at the curricula and timetables, and the proportion of subject blocks revealed that the management as well as the administrative boards of the college aimed to assure career socialization by means of strengthening the professional training aspect of the program and at the same time pushing aside the

aspect of training the intelligentsia.

Nevertheless, it is not known to what extent this strategy proved effective. We sought to answer this question via a longitudinal study that applied the technique of official surveys. We mailed a questionnaire one or two years upon graduation to our former students who earned their degrees between 1993-1997. In this questionnaire we inquired about their position at the labor-market, career socialization status and views concerning their academic education.

In the case of the mail-based survey we had to take the thematic competence, interest, time constraints and personal rights of our participants into consideration.

We tried to put together the questionnaire in a way that the number of questions would not discourage the participants, yet its quality would ensure unambiguity and intelligibility. Altogether the questionnaire contained 27 questions. Of the 17 closed questions 13 were multiple-choice and 4 required ranking. There were 10 open questions in the questionnaire. We decided to limit the number of open questions in order to make data processing easier.

As far as the structure of the questionnaire is concerned warm-up questions were replaced by demographic questions. Participants remained anonymous, so the main aim of these questions was to help place participants in time and according to their degree. The demographic section was followed by the main questions, which were classified thematically into three major categories: 1. circumstances of finding a job and employment 2. attitudes toward one's workplace and foreign language knowledge 3. opinions about academic education, its strong and weak points. The last two questions dealt with networking and future prospects.

The surveyed population included 1051 former students, 632 of whom sent back the questionnaire. Our sample was thus 60% of the surveyed population. Because the questionnaire was anonymous there was no opportunity to carry out a second or third follow-up study.

Computerized data processing seemed feasible, since our questionnaire yielded more than 30 data per person and we intended to have a sample of at least 600 participants. We decided to resort to manual data processing only last of all.

In order to prove that the contingency tables with the raw data of the 1051 graduated students are close to the adequate frequencies of our sample we applied a validity test, which yielded positive results. Consequently, *findings are applicable to our entire population.*

Results of the survey are the following.

According to the introductory demographic questions the proportion of female respondents was slightly higher than that of male participants. Moreover, grade point average of the degree also correlates with willingness to participate, 60 -70% among former graduates with excellent and good results, 40 - 50 % among those with average and satisfactory grade point average. We also looked at the number of participants in different years and found that the earlier people earned their degrees the more willing they were to participate.

80% of all graduates and students at our college have been traditionally male. According to our data the proportion of women increased in recent years, in 1996 and 1997 it even exceeded 20%. We attributed this fact to the new degree options (settlement engineer, environmental engineer, information specialist), which bring along better career and employment opportunities for women, too.

The first group of main questions dealt with circumstances of finding a job and employment. The geographical distribution of finding jobs depends on regions: graduates seek for jobs mainly in the Transdanubian region, near their homes. The distance between their home and workplace is most often less than 50 km, rarely 150 km, which means that they work in a big city or in Budapest. 60% of recent graduates find jobs at firms that employ maximum 200 people. According to the circumstances of employment approximately half of our graduates find jobs immediately upon graduation according to their degrees. Those who do not succeed at once tend to find suitable jobs according to their academic training within a relatively short time. It is also important to note that more than 10% of our graduates continue studying at some graduate program. The army often recruits recent graduates especially electrical engineers and information specialist-engineers. Six months after graduation the rate of unemployment is 10%, yet past another six months it is less than 5%, and two years after graduation this rate is under 1%. There are differences among different degree subjects. The employment of engineer teachers is outstandingly favorable. By and large we may conclude that the engineer and architect graduates from our faculty find their first jobs successfully within the first two years upon graduation.

The second group of main questions inquired about foreign language knowledge and attitudes toward one's workplace. 70% of the graduates from our faculty had basic foreign language knowledge, 30% had intermediate level knowledge. Very few people indicated proficiency in any foreign language. One third of our respondents thought they did not need foreign language knowledge. Those who found it important mentioned the significance of English and German.

As far as job satisfaction is concerned participants had to indicate

the level of their satisfaction on a four-point Likert scale, where positive and negative domains could be well distinguished. Approximately 12% of our engineer and architect graduates revealed their dissatisfaction, 12% left the question open, and two thirds of the respondents said they were satisfied with their jobs.

In the rank order of the criteria to choose a job income came first, professional opportunities were ranked second and individual interests such as expected promotion, distance from home and other benefits followed.

The third group of main questions inquired about opinions about college education. Two-thirds of graduates claimed they were satisfied with the chosen degree. The picture is less favorable about the quality of education. The rate of those who said they were unsatisfied to a varied extent exceeded 50%, the only exception being engineer teachers, 62% of whom claimed they were satisfied. Among the reasons for dissatisfaction respondents mentioned out-of-date materials in teaching, problematic lecturing abilities of instructors, proportion and quality of on-the-job or practical training. At the same time when subjects that give useful knowledge had to be ranked respondents listed almost all subjects.

Among the closing questions we inquired about possible further training. The rank order of fields our respondents gave (foreign languages, computer programming, economics, further professional training, engineering practice, human resource management) shows the strong demand to include non-engineering related disciplines into the program-framework of engineer and architect training.

Based on the survey we can conclude that despite the numerous difficulties our college policy is justified to reform its academic programs. The labor market position and opportunities of our former students prove this, too. Their views about training and program development should, nevertheless, be considered. The more so, since our college educates engineers not only for a middle-class based society, but also members of a well-informed and educated intelligentsia having to meet higher expectations.

Besides, we have to find the answer why recent graduates have negative attitudes toward the training institution despite their strong position and opportunities at the labor market.

5. Tendencies of personality development

In this part of our survey we aimed to examine how academic studies at the technical college form and change the personality of students during a period of deeper social and economic changes.

We used psychological tests to map how and to what extent the environment, a medium of socialization, changes personality as a variable during academic training. In the mid-1980s and 1990s we

carried out comparative, longitudinal and cross-sectional studies with the help of standard CPI tests.

Participants in the longitudinal study were students who successfully completed their studies and passed their final examination. The transversal study included a group of participants with unsuccessful career socialization, respondents with only secondary education and a third group of practicing engineers and architects.

As a result we gained tendencies, which can be summarized in the following statements.

We found that academic education yields positive changes in the field of sociability, social conduct, determination and striving for dominance.

Factors showing the individual's scale of values, however, stagnated in both periods. Since this is in close relationship with the larger society's scale of values, academic education and thus the college has only partial responsibility in such a tendency.

Democratic, middle-class values can, nevertheless, be more strongly advocated and mediated during academic education as well through the value and norm system of instructors, their sense of responsibility and a close personal relationship between them and their students. Recent trends toward mass education, however, do not support this process.

In the second phase of the survey we found that the extent of socialization decreased, yet tolerance increased. In our interpretation this signifies a decline of social maturity and sense of responsibility, yet a growth in the ability to negotiate interests between the individual and his environment.

The comparison of engineers and engineer-teachers proved that including humanities in the curriculum, small-group or individual training in personality development, conflict solving and self-knowledge might bring changes in the formation of personal values.

We can conclude that the personality development of our students showed positive changes during their academic education, although to a less extent than expected, as a result of which it is more difficult for them to overcome the problems of changing scale of values when they start their careers.

6. Results, discussion and conclusions

In our study the findings and conclusions refer to the period in career socialization between the first year of academic education and two years upon graduation at the University of Pécs, Pollack Mihály College of Engineering. However, the findings may be well

worth considering, since our college is part of the Hungarian higher education in engineering.

The studies focused on three major areas according to the particularities of four-year-college engineer and architect training: 1. curricula, 2. position (opportunities) at the labor market, 3. personality development. The studies aimed to reveal processes rather than register temporary conditions.

The major findings are as follows:

1. The analysis of curricula proved that

- a. the basic document of four-year-college engineer and architect education hardly fulfils its role in human resource development through training new members of the intelligentsia, and it strongly insists on the overwhelming dominance of the professional training aspect despite the proportions set in the graduation requirements (achievement targets);
- b. there are quality- and quantity-related deficiencies throughout the course of training, and the lack or insufficient presence of these disciplines is further justified by the demand of students to continue education.

2. The survey and analysis of the opportunities of graduates at the labor market proved that

- a. as regards educating young technical intelligentsia in the South Transdanubian region the University of Pécs, Pollack Mihály College of Engineering is a school of true significance in part because of its intellectual attraction and *regional* monopolistic position;
- b. the rate of *unemployment* among young engineer and architect graduates decreases from 10% to 1% within two years after graduation;
- c. *human resource development* as part of the program for engineer and architect teacher trainees improves the employment opportunities of graduates to a verifiable extent;
- d. engineer and architect graduates get employed according to their degrees, mostly at small businesses with less than 200 employees;
- e. *income* is the most important consideration when choosing a job, closely followed by *professional aspects*.

3. Personality assessment found that

- a. we found that academic education yields positive changes in the field of sociability, social conduct, determination and striving for dominance;
- b. the stagnation in the case of factors indicating the individual's scale of values can be a source of further problems;
- c. the personality development of our students showed positive changes during their academic education, although to a *less*

extent than expected.

According to the hypothesis and the results of our studies we concluded the following:

1. The majority of students at the University of Pécs, Pollack Mihály College of Engineering come from the South Transdanubian region and most of them want to return and find jobs in their hometowns. Recent graduate engineers and architects get employed mainly at small businesses, and they find the circumstances to become part of the intelligentsia mostly in smaller or bigger cities of the region. *Production oriented engineering positions* are more available for recent graduates. The educational institution may help the career socialization of graduates with the help of specific training for such tasks.

The study has proved that the Pollack Mihály College of Engineering, later a school of the University of Pécs takes students from all over Hungary, and graduates also settle in all areas, however, the majority of students come from the South Transdanubian region and find jobs there as well. Consequently, our college plays a crucial role in forming the young, technical intelligentsia in the region.

2. The research has shown that before 1989 our curricula identified economic disciplines and humanities with spreading one particular ideology. At that time this practice was widespread in the entire technical higher education; the more so, since it was the communist party's responsibility to manage human resources.

Curricula responded very slowly to fast and important social changes and challenges and even thus they mostly neglected the potential of human resource development. Political transition brought along the transition and return from "proletarian culture" to middle class life and culture. The subject groups of economics and humanities could have supported best this transition. The college, however, did not exploit this opportunity to help the career socialization of students, since college management did not recognize the fact that the career socialization of graduates depend *in part on the professional knowledge of engineering and in part on the acquisition of the culture of middle-class intelligentsia*. That is the reason why engineer or architect teachers who better find their way in the culture of middle class intelligentsia find adequate jobs easier than graduates without teaching degrees.

We can conclude that during the past three decades engineer-training programs attributed all importance to the acquisition of professional knowledge neglecting efforts toward developing some general knowledge. The Ministry of Education usually found such views very problematic earlier than some higher education institutions recognized it.

3. Our results have supported the hypothesis that the bulk of our students are still male, yet in recent years though their majority

decreased from eightfold to fourfold. Some of the socialization problems are due to the unnatural proportion of sexes.

Education deficiencies mainly refer to students not keeping basic behavioral norms. Yet behavioral education was always given less importance than the academic program.

Political transformation brought along gradual changes: outside control became weaker, and laid more emphasis on such personality traits as the level of socialization and tolerance.

Therefore, our conclusions must be less straightforward. Thus, in the last decade the level of socialization among students deteriorated, which means that from a positive viewpoint they became more relieved and entrepreneurial, yet from a negative viewpoint they are more unrestrained and unscrupulous. They are more tolerant, and became more goal-oriented and conform to the circumstances.

4. In our work we have supported that the majority of our students come from four-year-vocational secondary school and the minority come from secondary grammar school. Therefore, they have dissimilar secondary school experience and knowledge, which also affects their college education. Different backgrounds affect results in mathematics. Consequences are serious, long-term and sometimes even threaten some fields of the academic program itself.

Another problem area of college education is the acquisition of foreign languages, which is now a requirement to earn the degree. In many cases this is a serious problem for students before completing their studies.

It is also hard to implement the practical side of engineer and architect training, since solutions found at times are only partially acceptable for different degree major programs. We could for example tackle the educational deficiency in the field of computer science within a mere few years.

Based on these facts we can accept that there are qualitative as well as quantitative deficiencies in our academic program, yet these can be clearly defined on the basis of further education demands of graduates.

5. We have assumed that graduates from the college possess enough knowledge to start their career, the engineering profession acknowledges their degree and consequently, they can be satisfied with the training. Successful state examinations, and oral feedback from recent graduates at degree majors' annual reunions further support this assumption.

We have, however, received more detailed and critical picture from graduates who have their work experience and growing professional competence.

Opinions largely differ from one another as regards the standard of the education program. Concerning some issues views are very positive, whereas in others they are rather negative. There are some extreme opinions as well though those do not occur very frequently. Paradoxically sometimes even those who claim to be satisfied are not really satisfied. Those who say they are not satisfied unanimously find the content of training outdated, and its theoretical rather than practical nature. The reliability of the views of our former students is further justified by the fact that they think it is not only the responsibility of the college but theirs as well. It is also important to mention the standpoint of engineers and architects, who do not work according to their degrees, yet are satisfied with the academic education because their qualification proved useful in other fields, too.

According to the results of our research our hypothesis regarding the level of satisfaction of graduates is too optimistic. We think that the picture about academic education shows an unbalanced state, which reflects negative opinions. These can be changed within a relatively short time considering updating the curricula, becoming more practice oriented and involving the human factor to a greater extent.

6. We have proved that our graduates have good chances at the labor market contest. This is largely due to the college policy, which strived to accredit degree majors in demand and discontinued those that did not prove to be marketable.

It seemed hard to balance the quick spread of mass education, a decrease in practical training and the limited number of instruments, which got dated fast. These problems could at least in part be tackled with educating innovative intelligentsia. Nevertheless, such educational goal requires the development of the creativity, communicative competence and personality of our students besides the acquisition of professional knowledge and competence.

We have revealed that finding the first job is a longer process, which demands more than just professional knowledge. Acquisition of humanities improves the opportunities of graduates to find jobs. This correlation was hardly known and acknowledged at our college in the 1990's and subjects related to economics and humanities were treated accordingly in the curricula.

We have come to the conclusion that graduating engineers and architects participate and find employment in the labor market contest. In this competitive situation they find useful both their professional education and their general knowledge including the ability to practice middle-class culture and norms. *Finding a job takes one or two years* in the case of recent graduates, which justifies strong hold at the labor market as well as successful career socialization.

7. In our last summative hypothesis we have claimed that *the career socialization* of engineers and architects who graduated from the University of Pécs, Pollack Mihály College of Engineering is *satisfactory*. Professional knowledge in engineering and/or architecture proved to be enough for finding a job and start a career.

We have proved that the overwhelming majority of the graduates are satisfied with their degree majors. Their career socialization is also satisfactory, since *two thirds of them find jobs according to their qualification*. Although income is a prime consideration in choosing a job, it is closely followed by professional opportunities, which is an important result in career socialization. Graduates find jobs within two years the longest, and practically nobody remains unemployed by then. Their career socialization is reliable most of them keep the chosen profession. The majority of them work according to their degree qualification, and the proportion of such graduates show an increase with time.

During this study we have also come to conclusions that may help improve career socialization. We have proved that professional training cannot be the only means of career socialization. The intention to find a job can be fulfilled if the training is practice and production oriented. The results show that our students reveal less demand toward knowledge that helps successful career socialization during the years of academic education and stronger demand in the wake of graduation.

We can conclude that there *are no immediate problems of career socialization among the graduates from our college*. In the study we attempted to reveal and introduce those aspects that have to be strengthened and improved in the near future in order to keep the status quo.