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Electronics Engineers—Correlation between Scores toward B.Sc. and the Professional Work Level*

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This article deals with the outcomes of an engineering curriculum. The article describes a research where the efficiency of the curriculum for communication engineers was examined by testing the rate of success at work and the correlation coefficients between the accumulated average score at the end of the B. Sc. studies (sometimes called GPA—Grade Point Average) and success at work. The correlation between academic achievements and the level of professionality could imply that curricular changes are required and that teaching methods can be improved, as well as the scoring and evaluation methods.

INTRODUCTION

A REVIEW of the research literature shows that there are several approaches to the evaluation of engineering education curricula. According to one of the models [1] evaluation research can be carried out while examining the goals, methods, performance processes and outcomes.

This article deals with the outcomes of the engineering studies curriculum. The article describes a research [2] where the efficiency of the curriculum for communication engineers was examined by testing success at work and its correlation coefficients to the accumulated average score at the end of the B. Sc. studies (sometimes called GPA—Grade Point Average).

The idea behind this study was that every educational institution which trains engineering manpower in whatever level, wishes to integrate in the curriculum the right study contents, use advanced and efficient teaching methods, examine and score appropriately, and that the alumni succeed in their work. The required outcome is not only proper learning achievements, but also success in the profession acquired in the training program.

But the findings of this part of the research have further practical and theoretical significance. They can indicate the predictive validity of the academic achievements, so that the research, in fact, also examines to what extent these scores can serve as a selection tool to predict the alumni success at work.

Some organizations use a comprehensive selection process which includes the use of several tools, such as: Biographical information blanks, references, interviews, psychological and/or graphological tests, evaluation centers, etc. In those organizations, academic achievements are *another* selection tool, whereas in organizations which do not perform selection tests, academic achievements are often the only quantitative selection tool.

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ACADEMIC ACHIEVEMENT AND PREDICTIVE VALIDITY

As already mentioned, this study examined the predictive validity of the accumulating average score at the end of the undergraduate studies. We are now going to discuss the meaning of this score.

The final score of the undergraduate, in most academic institutions, is an average score, weighing the student's achievements in the studied subjects. Scoring is generally done according to a semestrial follow-up (tests and exercises) and a final exam. But what, in fact, is the significance of these scores, what do they reflect and what characteristics do they indicate? To what extent do the scores predict success or failure later on? What abilities, skills, knowledge and personality traits do they reveal?

According to Anastasi [3], achievement tests are meant to evaluate the results of the curriculum implementation or the learning/instruction which takes place under known and supervised conditions. Although the achievement tests represent the final evaluation of the individual's level upon the end of the training process, they also examine relatively extensive and undefined learning experiences, thus serving to predict learning in the future. All the capability tests, including the achievement tests, measure the development level which the

individual achieved in one skill or more, but no test reveals how or why the individual reached this level.

Bloom [4], Thorndike [5] and others point out the possible uses of the achievement tests: a tool for policy makers, examining learning goals, creating learning motivation and its alignment, evaluation means of the achieved ability, selection, examination of the relative location/place of the individual in class *and predicting the student's chances in the proceeding stage of studies.*

It seems, therefore, that literature 'hints' about possible links between scores and the extent of success in the next stage. But is this only about success in continuing studies or also in other relevant spheres, such as success at work, for instance?

ACHIEVEMENT TESTS CRITERIA

Achievement test criteria should include objectivity, standardization, reliability and validity. We are now going to discuss briefly these criteria as relating to the present research. We shall point out, specifically, a few reservations with regard to the scores on which this study is based.

Standardization

The main disadvantage of the use of an overall score is that it prevents easy comparisons. If, for instance, a student finishes his or her studies with an accumulated average of 82 then he or she is *relatively* better than a student who finishes in another year with an average of 81? Similarly, it is possible, for instance, that an evaluation score 'A' of one supervisor is *relatively* better than the evaluation score 'A+' of another supervisor in the same organization.

As part of facing this problem, this research has used standardized scores for which averages and standard deviations were taken into account.

Objectivity

A test will be considered *objective* if scoring depends neither on the test designer nor on the examiner. A test with a *good standard* is one where its components are determined beforehand, as well as the scoring and the test procedure. Most of the standardized tests include *closed questions* (multiple choice, true/false, matching, etc.) whose scoring is more objective, which reflect the material better, are more decent and prevent/do not allow/exclude 'blabbering on'.

This as opposed to the *open questions* where the examinee has to phrase his answer in his own language or pass an essay-type examination.

Most of the scoring in academic institutions (including the scores on which this research is based) is based on achievement tests which include open questions—signifying a certain 'injury' to objectivity.

Reliability

Measurement reliability is its rate of precision. We shall not deal hear with the theoretical definition of reliability, but with optional definitions. According to Anastasi [3], reliability means consistency in the scores obtained by the examinees when:

(1) they take the same test again (consistency in time), or
(2) when they are tested in parallel versions of the same test (consistency in contents), or
(3) when the test is checked by two evaluators (consistency between evaluators).

In other words, the reliability coefficient is the correlation between two series of scores obtained by one of the following methods:

(1) *Test/retest*—reliability in the form of stability.
(2) *Transfer of parallel versions*—reliability in the form of homogeneity. (The methods which enable to measure homogeneity by one test transfer—calculating Cronbach's alpha coefficient and using Kader-Richardson's split-half formula—will, however, not be detailed here).
(3) *Test evaluation by two evaluators*—inter-referee reliability between referees.

It is not customary in academic institutions to examine the reliability of the various tests. A check by two evaluators is usually only done in case the student appeals. We, therefore, have no data on the precision of the score measuring upon which this research is based.

Validity

According to Anastasi [3], the validity of the test is the evaluator's measurement of what was intended to be measured. Literature mentions five kinds of validity:

- face validity
- concurrent validity
- predictive validity
- content validity
- construct validity.

This research deals with predictive validity.

Despite the reservations we expressed regarding objectivity, reliability and validity of the achievement tests on which this research is based, we consider it important to examine the predictive validity of the final undergraduate scores. First, because in practice many employers and selection institutes use these scores as a selection tool without being at all aware of these problems. It is therefore useful to know to what extent this application actually reaches its goal. Secondly, the research findings may motivate the various academic bodies to deal better with examinations and scores.

PROFESSIONAL SKILLS

We shall now proceed to discuss the dependent variables of this research. *Success at work* in the

sense of this article means *a high level of professionality*. The professionality component in hi-tech organizations is most important for requirements and technological challenges which the organization's engineers have to face. Based on TQM principles, we suggest the following definition of professionality: 'The capability of the individual to give a prompt, reliable, qualitatively and quantitatively valuable answer to the organization's requirements'.

Research literature shows that the five main factors which influence the level of the individual's professionality in an engineering workplace are as follows.

Engineering education

Engineering education is a vital and basic precondition to speak the 'engineering language'. The engineer needs thinking tools and methodological tools which can be acquired in academic institutions and in training courses. General education does not necessarily provide the relevant professional skills. It only 'signals' the employer the potential of the candidates and whether or not it is worthwhile investing in them.

Knowledge

According to Bloom *et al.* [4] knowledge includes remembering facts, items and entities, methods and processes, principles and theories, structures and systems. Knowledge is expressed by measurable indicators such as factual knowledge, general technical skills and skills in the relevant field.

Experience

Dalton, Thompson and Price [6] developed a model which describes the career stages of professional workers in hi-tech organizations. According to this model, there are four stages in the professional development of the engineer in the organization:

- *Stage 1* (1–3 years): training without managerial status. Assisting, learning and fulfilling instructions.
- *Stage 2* (up to 10 years in the organization): independent activity, assuming responsibility, developing a specialized field of specialization.
- *Stage 3*: interim management, in charge of a group, dealing more with concepts and characteristics, instructing others, connected with people outside the organization.
- *Stage 4*: senior manager whose decisions influence the entire organization, remote from people in the field, involved in strategic decisions.

According to this model and for the purpose of this article we define that a *junior engineer* as an engineer with one to ten years of experience, performing the first or second function in the organization.

Approach

This term refers to the way of thinking as a means to deal with problems and finding solutions. For example, Dean and Plants [7] developed the Problem Solving Taxonomy which includes five levels of cognitive difficulty and which is especially suitable for analyzing engineering tasks: routine, diagnosis, strategy, interpretation and generation.

Engineering solutions require a combination of two approaches. The first, intelligent thinking based on convergent thinking which leads to a right solution based on knowledge and experience. The second, creative thinking based on divergent thinking, which leads to the optimal solution. A highly qualified engineer can make the utmost of combining the two thinking modes.

Creativity depends on personality features linked to independent thinking, self-discipline, non-conforming thinking and independence from social consent [8].

Work motivation

Motivation is based on the aim of the individual to satisfy needs. Beside the needs required for basic existence, there are mental and social needs which demand satisfaction. Unsatisfied needs arouse an impulse which leads to behaviors intended to satisfy the needs, re-establish balance and decrease the impulse.

Several theories deal with the link between motivation and output (quality and quantity) at work. The main theories are:

- the Needs Theory [9];
- the Two Factors Theory [10];
- the Job Enrichment Theory [11];
- the Equity Theory [12];
- the Expectancy Theory [13];
- the Theory of Goal Setting [14].

Thus it seems that many factors influence success at work. We studied some of them. There are probably many other factors which contribute to the error variance of the evaluators' scores with regard to the criterion. This study examined the correlation between final study scores and the level of professionality. The findings of the study do not teach us about the correlation between each of the factors which influence the scores and every factor that influences the level of professional skills. They only give us a general indication.

THE RESEARCH METHODS

We must now answer two questions. First: *What is measured when referring to 'professionality'?* Job analysis is a process of defining the tasks implied by a certain function, thus defining the criteria for successful functioning. In this research we did not perform a job analysis in the field, but in order to prepare the questionnaire to assess the professionality level, we used the employee evaluation

forms validated in the various organizations which had been prepared on the basis of job analyses.

Then we must answer the second question: *How to measure professionality?* There are four approaches to assess workers: evaluation by the supervisors, evaluation by the subordinates, evaluation by peers and self-evaluation. In this research we used the evaluation by the supervisors.

Within the framework of this part of the study a questionnaire was prepared to assess the professional skills of communication engineers. The evaluations were carried out by the direct supervisors. The questionnaire items were based on a literature survey, professional skill definition and the findings of the research on the development of the SCAW model [15]. The validation was based on evaluation forms of the workers as used in the various organizations. The supervisors were asked to assess their subordinates according to the absolute evaluation method.

The evaluation scale in the questionnaire was, as already mentioned, a 7-scale type. This is the scale used in workers' evaluation forms and it was found suitable for the purposes of this research. In the first stage a questionnaire was developed which included 26 items, but following the lessons learnt after the first 'running-in', the number of items was reduced to the strict minimum. The final version of the questionnaire consisted of seven items as detailed in Table 1.

There is a distinction between absolute evaluation where the assessor has to consider the worker independently of the others, and relative evaluation based on comparison between the workers. The method of relative evaluation does not explain the gaps between the workers and the relative grading in one group cannot be compared with that of another group of workers. Therefore, we used the absolute evaluation in this research, using standardization in order to enable comparison.

Table 1. Professionality level evaluation questionnaire.

Item	Remarks
Shows high level theoretical skill in his field	The quality component in the professionality variable, as well as the variable influencing professionality
Capable of high level practical work	Reliability component of the professionality
High work capacity	The quantity component in the professionality variable
Capable of learning new subjects	Opinion of leading industrialists and technological training systems
Having system thinking aptitude and capable of dealing with multidiscipline subjects	Opinion of leading industrialists and technological training systems
Shows a high level of inventiveness and creativity	Component of divergent thinking in the 'approach' variable
General evaluation of the professionality level of the assessed	

Throughout the research there were difficulties with regard to the 'running-in' of the professionality evaluation questionnaires. This is a delicate subject and some of the supervisors at the working places were afraid to cooperate and give evaluations, mainly for reasons of loyalty to their subordinates. In addition, for the data to be statistically significant, it was necessary to choose working places with a relatively large concentration of communication engineers who had graduated from the same academic institution and who were working under the same manager. While searching, we realized that there were no such concentrations. Communication engineers are widely scattered, and only relatively small concentrations of them can be found in companies.

After considerable efforts we located five organizations where the supervisors agreed to cooperate with at least eight employed graduates from an academic institution relevant to the research. In total we received data on scores and evaluations for 45 graduates. Since there were differences between the various supervisors, we used norm scores to enable a comparison between the evaluations of the various supervisors.

While analyzing the research findings we must remember also the main problems of the evaluation process: judgement is influenced by the cognitive style of the assessor, there is an influence of non-cognitive factors related to the assessor, and there is bias, such as impact of the first (or last) impression, and a tendency to be strict or facilitate.

There are various methods for preparing evaluation scales. In this research we used the method applied by all the organizations where this research was done—graphic scales where each item in the evaluation blank is accompanied by a descriptive sequence from 'best' to 'worst'. The research scale was based on seven spaces.

The findings of this part of the study and the following analysis should therefore be considered carefully. On the other hand, despite all the difficulties and limitations, it seems that the idea behind this part of the research is applicable. If any authority considers this subject important, provides the necessary resources and intervenes to obtain the cooperation of supervisors at work places, such a research is possible in order to obtain wider-scale results.

MAIN FINDINGS

Within the framework of the research the correlations between the following variables were examined:

TOTAL—the accumulative average score at the end of the undergraduate studies.
A046204—the score in the subject 'Analogue Communication'.

Table 2. Correlation between Technion graduates' grades and the evaluations of the professionality level.

		TOTAL	A046204	D046206	T044214	N046334	Q1	Q2	Q3	Q4	Q5	Q6	Q7	ZZQ7
Pearson Correlation	TOTAL	1.000	.886*	.648**	.640**	.452	.508**	.195	.253	.421**	.337*	.283	.435**	.330*
	A046204	.886*	1.000	.109	.654	.403	.727	−.192	.321	.493	.303	.556	.556	.089
	D046206	.648**	.109	1.000	.556*	−.207	.284	.081	.179	.273	.265	−.137	.044	−.070
	T044214	.640**	.654	.556*	1.000	1.000	.645**	.307	.171	.500*	.298	.271	.417	.441*
	N046334	.452	.727	.403	−.207	.249	.249	−.376	−.128	.000	.172	−.118	.070	−.009
	Q1	.508**	−.192	.284	.645**	−.376	1.000	.578**	.480**	.614*	.745**	.641**	.788**	.710**
	Q2	.195	.321	.081	.307	−.128	.578**	1.000	.648**	.422**	.568**	.352*	.630**	.677**
	Q3	.253	.493	.179	.171	.000	.480**	.648**	1.000	.651**	.705**	.497**	.698**	.623**
	Q4	.421**	.303	.273	.500*	.172	.614**	.422**	.651**	1.000	.641	.704**	.790**	.628**
	Q5	.337*	.556	.265	.298	−.118	.745**	.568**	.705**	.641**	1.000	.706**	.773**	.632**
	Q6	.283	.556	−.137	.271	.070	.641**	.352*	.497**	.704**	.706**	1.000	.770**	.584**
	Q7	.435**	.089	.044	.417	−.009	.788**	.630**	.698**	.790**	.773**	.770**	1.000	.879**
	ZZQ7	.330*		−.070	.441*		.710**	.677**	.623**	.628**	.632**	.584**	.879**	1.000
Sig. (2–tailed)	TOTAL		.019	.003	.001	.261	.000	.206	.098	.004	.025	.063	.003	.029
	A046204	.019		.838	.231		.102	.715	.535	.321	.560	.252	.252	.867
	D046206	.003	.838		.025	.501	.239	.740	.464	.258	.274	.575	.860	.775
	T044214	.001	.231	.025		.693	.001	.164	.446	.018	.179	.223	.054	.040
	N046334	.261		.501	.693		.552	.359	.763	1.000	.683	.781	.869	.983
	Q1	.000	.102	.239	.001	.552		.000	.001	.000	.000	.000	.000	.000
	Q2	.206	.715	.740	.164	.359	.000		.000	.004	.000	.019	.000	.000
	Q3	.098	.535	.464	.446	.763	.001	.000			.000	.001	.000	.000
	Q4	.004	.321	.258	.018	1.000	.000	.004	.000	.000	.000	.000	.000	.000
	Q5	.025	.560	.274	.179	.683	.000	.000	.000	.000		.000	.000	.000
	Q6	.063	.252	.575	.223	.781	.000	.019	.001	.000	.000		.000	.000
	Q7	.003	.252	.860	.054	.869	.000	.000	.000	.000	.000	.000		.000
	ZZQ7	.029	.667	.775	.040	.983	.000	.000	.000	.000	.000	.000	.000	

* Correlation is significant at the 0.05 level (2–tailed)
** Correlation is significant at the 0.01 level (2–tailed)

D046206—the score in the subject 'Introduction to Digital Communication'.
T044214—the score in the subject 'Reception and Transmission Techniques'.
N046334—the score in the subject 'Introduction to Computer Networks'.
Q1 to Q7—Items 1 to 7 in the professionality evaluation questionnaire.
ZZQ7—Standard scores of item 7(in order to enable comparison between the scores of the various evaluators).

Table 2 presents the correlations between the above mentioned variables.

The matrix in Table 2 represents 72 correlations between the various variables. The correlations between a certain score and the other scores, as well as the correlations between a certain item in the questionnaire and other items are not the object of this research. We are dealing with the correlation between academic achievements and the components of the professionality level, and therefore we are practically only interested in 40 correlations in the table.

The table shows that only seven statistically significant correlations were found:

a. Correlation between item Q1 (shows high level theoretical skill in his field) and the accumulated average score.
b. Correlation between item Q1 and the score in the subject Reception and Transmission Techniques.
c. Correlation between item Q4 (capable of learning new subjects) and the accumulated average score.
d. Correlation between item Q4 and the score in the subject Reception and Transmission Techniques.
e. Correlation between item Q5 (having systems thinking and capable of dealing with multiple fields subjects) and the accumulated average score.
f. Correlation between the standardized item Q7 (variable ZZQ7) and the score in the subject Transmitting and Receiving Techniques.
g. Correlation between item Q7 (general evaluation level) and the accumulated average score, as well as the correlation between the standardized item Q7 (variable ZZQ7) and the accumulated average score.

Out of the seven statistically significant correlations, the most important one for us was the one between the accumulated average score at the end of the studies (final score) and the general evaluation of the professionality level. The table shows that the correlation between these two variables without standardization of the evaluation scores is 0.435, for a significance level of $\alpha = \text{Sig. (2-tailed)} = 0.003$. But it is more correct to standardize the evaluation scores. The correlation between the standard scores of the general evaluation of success at work and the accumulated average score at the end of the study period is 0.33, for a significance level of $\alpha = \text{Sig. (2-tailed)} = 0.029$.

DISCUSSION

The data presented in Table 2 reveal that the most important finding is that the correlation between the accumulated average score at the end of the study period and the standard scores of the general evaluation and the professionality level is 0.33 (for $\alpha = 5\%$). When we come to discuss the meaning of this finding, we must remember that the result of calculating the Pearson correlation coefficient is of proportional nature rather than absolute one. The obtained result must therefore be compared to the findings of other similar researches. It must also be remembered that the obtained calculation result is a function of the measured phenomenon. A certain correlation can be considered high for one phenomenon and low for another.

A common way of explaining the meaning of the obtained calculation result of the Pearson correlation coefficient is through calculating the explained variance percentage, here being $\eta^2 = 0.11$.

This means that 11% of the differences in the professionality level of the assessed engineers are explained by the accumulated average score at the end of the study period. All the other differences are explained by other factors. Some of these factors have already been mentioned above—education, knowledge, experience, approach and motivation. There are, apparently other internal and external variables, such as human relations at the work place, level of challenge, level of satisfaction, technical leadership aptitude, work morals, interest in the job, achievement drive, creativity, willingness to take risks, values, openness, readiness to face criticism, maturity, family situation, salary, discipline, etc.

We are now going to compare the obtained results to findings of other studies. A computerized survey in ERIC, ABI and PSYCLIT files showed works and research performed in the USA on work success prediction based on academic achievements (especially in colleges). There is a big difference between studies in the USA and this one regarding variables (predictors and criteria), the tested population, success criteria, learning institutions (content, duration, level, admission terms, scoring, etc.) and the employment characteristics. Therefore only the conclusions shall be presented here briefly:

- Dyer's study [16] which comprised 970 nurses college graduates found, through stepwise regression, that the best predictors of success during the first work year (according to the evaluations of the supervisors) were the biographical questionnaire and the GPA (Grade Point Average). About 15% to 20% of the

supervisors' evaluation difference is explained by the college scores.

- Baird's article [17], which sums up a vast literature survey on the subject of prediction of work professionality based on scores of college and high school graduates, states that there is *a very low positive correlation* (there are no quantitative data) between scores and professionality. The article deals with gifted, doctors, scientists, technicians and managers.
- In the Littlepage's research [18] which dealt with M. A. graduates in psychology, it was found that the most significant predictors for success at work as measured during 6 to 24 months after the end of the study period in terms of salary, job prestige and supervisors' evaluation (where given) are the B. A. score and the faculty grading.
- Bretz's article [19], which sums up findings of 39 studies carried out in the USA during the years 1922–1977 (meta-analysis), as well as an experiment comprising 277 college graduates and 88 Masters graduates in business administration, claimed that the GPA is generally a poor predictor of work achievements in terms of salary and satisfaction. An article which was published as a reaction in the following publication of the same journal, attacks the conclusions and claims, that based upon the results of 72 studies, it can be concluded that the GPA has a predictive value.
- Cohen's article [20], which sums up findings of 108 studies (meta-analysis), which examined the correlation between the GPA and success at work in the various professions, claims that the average correlation is 0.18, while the measurements for success at work are promotion, income and satisfaction.
- Muchinsky's research [21] which tested 183 engineers, examined the correlation between success at work after 5–10 post-college years, according to 17 criteria and four college scores (final score, last year's score, scores of the compulsory subjects and scores in the design subjects). It was noted that there are statistically significant correlations only in eight (out of 68) correlations. Also, the correlations found statistically significant were poor, and the author recommended not to use 'seriously' the college scores as predictors of success in work.
- According to Milkovich & Boudreau [22], the prediction validity of the academic achievements compared to the work performance level is lower than 0.2.

As stated above, there is a big difference between findings in the USA and our own. It is also evident, that the results of the studies in the USA are not consequent. However, it is obvious that wherever statistically significant correlations were found, their intensity is positively poor (correlations between 0.18 and 0.45 were found). These data resemble the findings of our research.

Can academic achievements predict the engineer's ability to learn new subjects? The results of the present research indicate a low positive correlation between academic achievements and the criterion of ability to learn new subjects. It seems that the influence of other variables is stronger. Does the correlation between academic achievements and professionality level decrease with acquiring seniority and experience? In order to answer this question a stepwise linear regression was performed, which revealed that the experience variable is not even included in the prediction equation. Therefore, in our case, experience does not contribute to explain the scores of the general evaluation level (variable ZZQ7), and does not influence the correlation between the final score (TOTAL variable) and the evaluation of the professionality level.

COMPARING TO OTHER SELECTION TECHNIQUES

We are now going to examine the efficiency of the various selection techniques in order to compare between the predictive validity of these selection techniques and the predictive validity of the academic achievements. There is a vast research literature about each of the selection techniques detailed hereinafter. We shall present here only a short summary based upon the data provided by Milkovich and Boudreau [22] and Gatewood and Feild [23]:

- *Application blanks and resumes*—weighed application blanks can increase the predictive validity to 0.56.
- *Life-history information and biodata*—the use of biographical inventories is based on the assumption that past behavior predicts the validity of future behavior. The predictive validity of the different criteria varies from 0.2 to 0.36.
- *References*—researches have shown that about 75% of the organizations rely on information supplied by previous employers. This is an important source of information if one accepts its limitations and if the material is treated carefully and if what is to be obtained is previously defined. The predictive validity varies around 0.25.
- *Interviews*—this technique is considered as hardly reliable nor predictive, and many articles deal with its deficiencies. In recent years various methodologies have been developed to increase the efficiency of this technique. Despite the mehodological weaknesses of the interview, resulting from its subjective evaluations, this technique has an important contribution, as it enables to distinguish between behaviors and qualities which cannot be measured by other tools. The predictive validity of unstructured interviews varies around 0.3, whereas the

predictive validity of structured interviews is over 0.6.

- *Psychological tests*—the main types are: Intelligence or General Mental Ability Tests, Ability or Aptitude Tests, Motor Ability Tests, Psycho-Motor Tests, Achievement Tests, Personality Tests (such as the Minnesota Multiphasic Personality Inventory Test or the 16 Personality Factors Test), Projection Tests (such as the Rorschach Test or the Thematic Apperception Test) and Interest Inventories. It is to be born in mind that tests examine a static situation, whereas the aspiration is to predict future functional success under conditions which are basically dynamic. In most of the tests the correlation between the predictors and the criterion are not high (an average of 0.4), but with some ability tests a predictive validity of 0.8 was reported.
- *Job knowledge tests, work samples and job try-outs*—the predictive validity varies around 0.4.
- *Graphology tests*—graphology is a widespread selection tool in various organizations in France, Germany, Holland and Israel, despite the severe criticism of the level of reliability and validity of this tool. The empirical testimonies relating the predictive validity of the graphological evaluations are pretty gloomy.

CONCLUSIONS

The correlation between academic achievements and the level of professionality could imply that curricula changes are required and that teaching methods can be improved, as well as the scoring and evaluation methods. Similar to the findings of the research to develop the SCAW model [15] it is recommended to create a permanent system of 'feedback' from the field. Once every few years a research should be carried out, including a needs survey, examination of the graduates' opinions and the correlation between academic achievements and the professionality level of the graduates. The data should be presented to a committee of the relevant engineering faculty staff, academics from the educational discipline and representatives of the industry. The committee will present to the faculty board recommendations for updating the curricula.

The findings of the research and the existing data for the various selection techniques indicate, that in certain cases academic achievements can serve, to a certain extent, as a selection tool during job candidacy examinations. Combined with other selection tools, academic achievements could contribute to improve prediction.

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