

Internal and external evaluation in entrance procedures at FA-STU

Ján Ilkovič, Robert Špaček & Ľubica Ilkovičová

Slovak University of Technology in Bratislava
Bratislava, Slovakia

ABSTRACT: Architecture has long been considered the mother of art. Society and architecture are changing, and so it is logical that changes may be made to the entrance procedures, which are a necessary condition for beginning study in a given field. In this context, entrance procedures are continuously being modified and modernised at the Faculty of Architecture, Slovak University of Technology in Bratislava (FA-STU). In this work, the authors deal with the Bachelor entrance procedures. The entrance procedure is an opportunity to seek an answer to the question of how to choose applicants for study who will then be successful in study. There have been several types of entrance procedure at the Faculty since the 1980s. Weightings and indicators for applicants are selected from art-scientific and exact disciplines. Also, the time demand of the process has been changed, and has been simplified in the light of the social climate and interest.

INTRODUCTION

The study of architecture at Slovak University of Technology in Bratislava (STU) has been connected with figure ground drawing architecture for more than 30 years and the entrance examinations reflect this paradigm. During the history of the school, the teachers (usually architects) were mostly convinced that when considering talent their own professional judgement was enough.

A combined entrance examination has been used that consisted of tasks from mathematics, physics, factual drawing and an oral interview. Results from secondary school were taken into consideration. A subjective judgement was made concerning the level of talent and interest in the chosen specialisation based on a factual drawing. After 1990, following the revival of academic freedom at universities, the correctness of this procedure started to be questioned. Doubts grew also in connection with the degradation of the value of education in secondary schools. Hierarchical regression and the decline in the competency of education means that the secondary school leaving examinations diminish as a predictor of performance at university. With respect to hierarchical regression, the secondary school leaving examination basically only has informative value [1]. Their relevance to entrance examinations is therefore questionable.

INNOVATIVE PROCESS FOR CHOOSING CANDIDATES FOR STUDY

External and Objective Testing

In the last decade of the 20th Century, study at the Faculty was opened up to a wider range of applicants. Entrance tests included the history of architecture and art, and later there were psychological tests. After 2013, the system was modified with the inclusion of external, objective testing of applicants. This was intended to eliminate unsuitable candidates and accept candidates of the highest quality. The entrance examination has two levels:

- Formal level - with a system of marking (coding) of work in the form of a 21-digit alphanumeric quick response (QR) code with an anonymous identifier.
- Content level - a compulsory test was introduced focused on general study and intellectual capabilities required for university study performed by the Scio agency, which is an external, private institution in the Czech Republic.

Results from the secondary school were not taken into account, because there could be a high level of subjectivity in evaluation of study subjects. In the Faculty, there was a question if the institutional and also subjective testing was enough to judge a subject. However, testing an applicant is much more complicated than at first apparent. *It is not so difficult to find people with talent, it is more difficult to find those who can develop and use their talent as well* [2].

There is no unambiguous answer to the question of the necessity of an entrance examination. Not having an entrance examination has the disadvantage that applicants can be accepted who are not prepared for university study and have no real interest in the study; hence, there is a lower probability of success in finishing the study [3].

DISCUSSION AND TARGET OF THE RESEARCH

Ten Levels of Talent

Talent belongs to the group of psychological cognitive and practical abilities. It is the disposition of an individual for fulfilling cognitive and practical tasks. Talent allows for the further development of abilities. Given this, it is appropriate to professionally check the talent of a candidate. It is questionable whether school results are an adequate measure of talent without an external professional assessment.

According to the typology of talent, there are 10 levels: genius, extraordinary creative, very creative, exceptional expressive, universal or expressive, very expressive, expressive above standard, above standard, slightly above standard and standard [4]. Given this quite complicated structure, it can be seen that judging talent is a professional matter and at the institutional level of a faculty, objectivity in determining talent would be difficult or even impossible to achieve. In FA-STU, the level of talent in terms of the above typology is not determined and, in the end, it cannot be said which level of talent is acceptable.

In the literature, the research of Daniel Coyl is inspirational [5]. In his book, he talks about three key elements which help in the development of a talent. Talent needs ...*practical practice, eagerness and a masters coaching, which influence the development of talent, genius, gift*. Coyl further opines that talent is not just a gift, but can be improved. Coyl relies on the group of psychologists who claim that the most expressive variable is not genes, but discipline in practice [5]. This is another reason to rely on a test of study prerequisites. Research by the Scio agency indicates that good results can be achieved when a teacher and a student co-operate to get successful results.

Exercising of skills, enthusiasm and direction create a basis for expressing talent and its development. Teacher as a master coach ... *overarching guidelines for success in the learning process is that one must first define the why, and then ensure that there is an alignment between the why and what. Only then can one design the creative strategy* [6]. Many studies declare that a creative talent in engineering education is necessary and irreplaceable. *Engineering studies can reveal and develop creative capabilities among the students* [7]. *Developing the creative abilities of future engineers is a task that obviously and unambiguously activates and expands knowledge (explicit and implicit)* [8].

The question is to what extent is talent necessary for quality architectonic output? Ingredients of quality are: motivation, persistence, co-operation and some talent [9].

Apart from the problem of talent, there is a question as to whether it is necessary to have some form of entrance examination at a university. Arguments against vary; for example, fluctuation in number of applicants for study or the degradation of education in general. In the states of the EU, there is no uniform way of choosing applicants. As is shown in Figure 1, there are states that have an absolutely open system of accessibility of education, while others are selective [10].

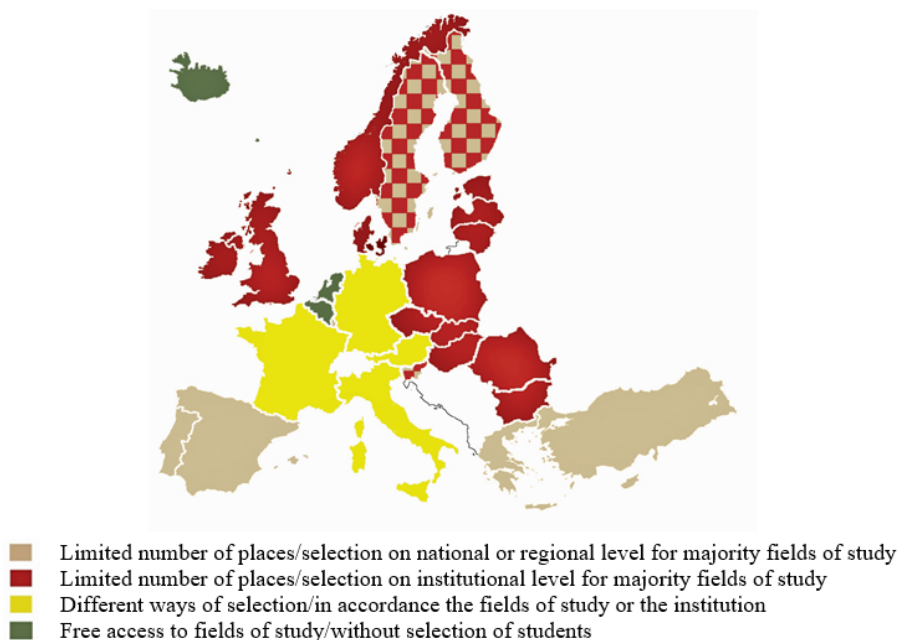


Figure 1: Comparison of entrance procedures at European universities.

In spite of all this, entrance examinations still have their place. Often, the result of the entrance examination (tests) is the only criterion determining whether a candidate gets into their desired programme. These standardised high-stakes test results are used to make important decisions [11].

The target of an evaluation process in entrance examinations is to secure the highest level of objectivity in choosing applicants. Entrance examinations should test a person's development synergistically and cover more than learnt knowledge or pre-learnt drawing skills. The uniqueness of talent is undeniable, but nothing can replace hard work [12].

The aim of this article is to present statistical analyses of the process and results of entrance examinations to examine the quality of the entrance system. The entrance examination is a relatively complex examination for applicants.

SELECTION OF APPLICANTS BY THE ENTRANCE SYSTEM

Examinations to Attract Best Students

Entrance examinations at FA-STU are predicated on only the best students coming to study at the Faculty, i.e. those who have an intense interest in the study of architecture or design. The task of entrance examinations is to choose from the applicants those most likely to be successful in study. Content, form and organisation of entrance examinations should be subordinated to this target. Since the start of architectural studies, the authors have been sure that creative talent is necessary for the study of architecture. It is only one aspect. It does not matter when drawing has been taught or what was actually covered in the course. What is important is that it has been taught, and still is. The aim is to cultivate the talent of the students and make them more sensitive in their perception of architecture [13].

The priority for the methodology of applicants' selection is to create a balanced system for choosing applicants. There is an opinion at FA-STU that the process of verifying the study and talent prerequisites should have a minimum of two parts, viz. a graphical part and a verbal part. Nowadays at the Bachelor level there are two parts. The first focuses on verifying the level of talent and the second on examining the general study prerequisites in the form of a test.

In the past, there was insufficient emphasis on what applicants know, as opposed to their prerequisites for study. A doubt arose as to whether for a successful study, and then a successful performance in a job, the skills, knowledge and talent were important at the entrance to university or was the potential (capability) for study and development more important.

Testing the quality of applicants in the form of an entrance examination at FA-STU after 2013 is divided into three tasks (see Figure 2 for tasks 1 and 2) followed by an external Scio test, task 4. Following are the tasks and the weightings:

- Task 1: Drawing of a still-life model (weight: 0.2)
- Task 2: Composition from geometrical bodies (weight: 0.3)
- Task 3: Test of spatial imagining (weight: 0.3)
- Task 4: Test of general study prerequisites (weight: 0.2)

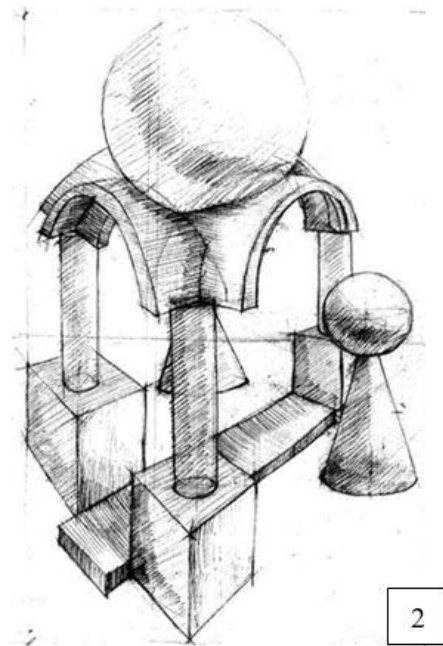


Figure 2: Examples of the applicants' work from the entrance examination (tasks 1 and 2).

In the final result, the sum of all the tasks is presented, including Scio. Too big a weight in the results from tasks 1 and 3 and too little from tasks 2 and 4 can result in an applicant being not accepted for study. Another phenomenon is the emergence of entities to prepare an applicant for entrance examinations. Answers rehearsed in advance do not show real creative talent potential and the visual results of *drawings* are mistakenly considered to be a level of talent.

Research has been undertaken to compare entrance results with results for prerequisites. At the beginning, the research was done by psychologists and the agency Scio.

The research seems to verify two seemingly contradictory hypotheses:

1. Selections of applicants for study can be objective at the institutional (school) level by using the entrance examination and visual work.
2. The external adjudicator has a more complex view recognising prerequisites for study. The external consideration of applicants produces a more objective and fair process.

PROBLEMS OF INTERNAL ENTRANCE EXAMINATIONS

Neither Definite Objectivity nor High Reliability

The aim of entrance examinations in a study programme of architecture and urbanism is to verify the prerequisites of an applicant. They reflect the requirements of the International Union of Architects (UIA) for architects and they include requirements for graduates to create architectonic designs satisfying aesthetic criteria. These are verified by a test, including graphic tasks. In the graphic tasks, an applicant demonstrates the ability to perceive and reproduce a space and its parts - in the form of a still life drawing of a model. In the test of spatial imagination, the applicant assembles a composition from geometrical bodies. These test the ability to express basic space connections, correctness of display and proportions, and in the compositional task, invention and design.

Two studies have been undertaken:

- A comparison study of the success of students in studies compared to the results of an entrance examination in 2017.
- A sample of students in the second and third years of a Bachelor degree were studied to determine the relationship of their success in studies to passing the entrance examinations (see Tables 1-4, Figures 4-8). Used in the research was a statistical sample of 10% of students with a high and minimal success at the entrance examination and during their study.

This research included results of the Scio tests and continuous study results. An inaccurate variable was the level of success in the profession, and the data were not evaluated. However, there are results using linear and nonlinear combinations of: *...level of success in the entrance exams - level of success as a professional* (extrapolating from the second level of study). All possible combinations were considered (see Figure 3):

- High success at entrance examinations - high success at study - high success in the profession - level 3;
- Average success at entrance examinations - average success at study - average success in the profession - level 2;
- Minimal success at entrance examinations - minimal success at study - minimal success in the profession - level 1.

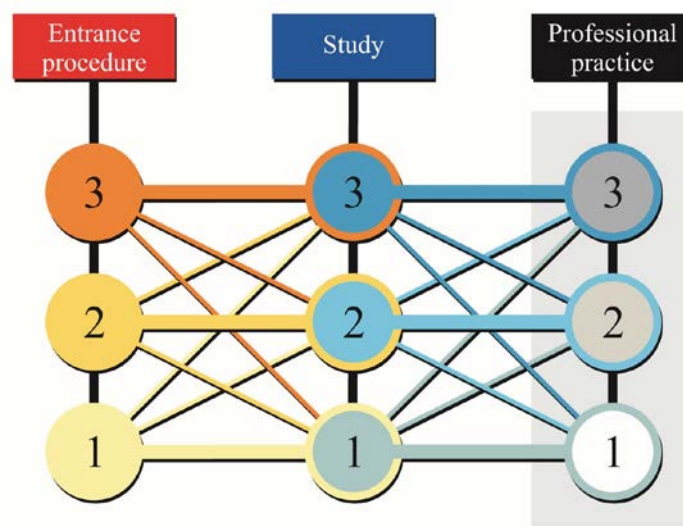


Figure 3: Success levels for students in: entrance examination - study - practice.

Based on the results of research, there is neither definite objectivity nor a high reliability of entrance examinations as predictors of performance in studies or the profession.

Table 1: High-success students on talent examination.

Student (1-x)	Examination 2015	Examination 2016	Scio test 2015	Scio test 2016	WSA 2015	WSA 2016	WSA recalcul.*	WSA recalcul.*
1	67.5	76.0	65	86	1.64	1.36	47.2	52.8
2	65.0	74.0	75	32	1.07	1.33	58.6	53.4
3	62.5	72.5	44	34	1.51	2.58	49.8	28.4
4	61.0	71.5	55	42	1.57	1.62	48.6	47.6
5	58.0	70.5	33	92	2.64	1.49	27.2	50.2
x								
20	46.0	59.0	40	76	1.48	1.28	50.4	54.4

Notes: * Recalculation of weighed study average (WSA) is given by $\{[10*(4-WSA)]*2\}$.

** WSA = weighted study average

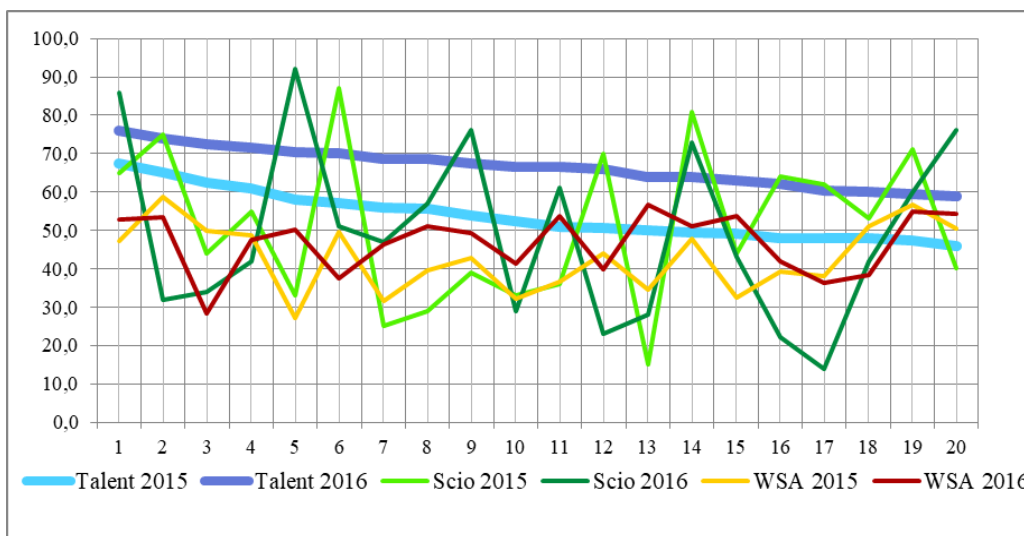


Figure 4: Relationship of study results for high-success students on the talent examination.

Table 2: Students with high results on the Scio test.

Student (1-x)	Scio test 2015	Scio test 2016	Examination 2015	Examination 2016	WSA 2015	WSA 2016	WSA recalcul.*	WSA recalcul.*
1	91	92	40	70.5	1.33	1.49	53.4	50.2
2	87	86	57	76	1.52	1.36	49.6	52.8
3	85	80	43	49	1.79	1.71	44.2	45.8
4	85	76	44.5	67.5	1.22	1.53	55.6	49.4
5	83	71	26	56	1.64	1.98	47.2	40.4
x								
20	55	56	61	35.5	1.57	1.68	48.6	46.4

Note: * Recalculation of weighed study (WSA) is given by $\{[10*(4-WSA)]*2\}$.

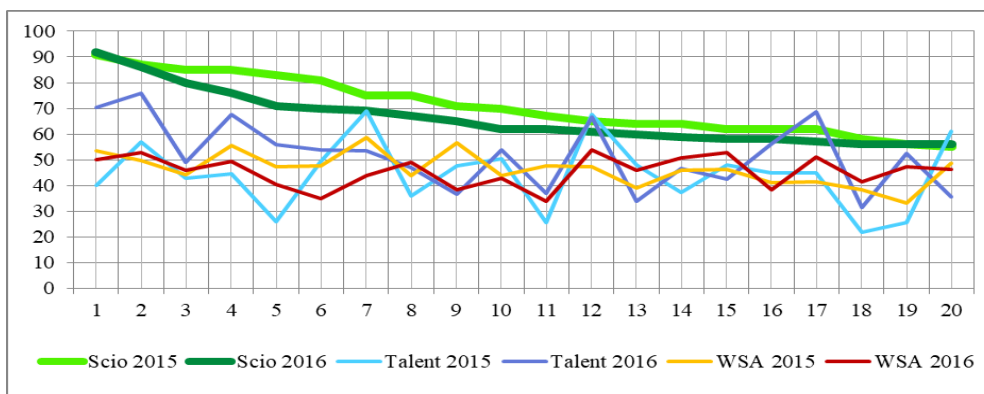


Figure 5: Relationship of study results for students with high values on the Scio test.

Table 3: Low-success students on the talent examination.

Student (1-x)	Examination 2015	Examination 2016	Scio test 2015	Scio test 2016	WSA 2015	WSA 2016	WSA recalcul.*	WSA recalcul.*
1	21.5	31.5	44.0	45.0	1.87	1.76	85.2	89.6
2	21.5	31.5	43.0	56.0	2.25	1.93	70.0	82.8
3	22.0	33.0	58.0	42.0	2.08	2.50	76.8	60.0
4	22.0	33.5	31.0	41.0	1.80	1.89	88.0	84.4
5	22.0	33.5	30.0	42.0	1.67	2.00	93.2	80.0
x								
20	27.0	37.0	37.0	16.0	1.95	2.13	82.0	74.8

Note: * Recalculation of weighed study average (WSA) is given by $\{[10*(4-WSA)]*2\}$.

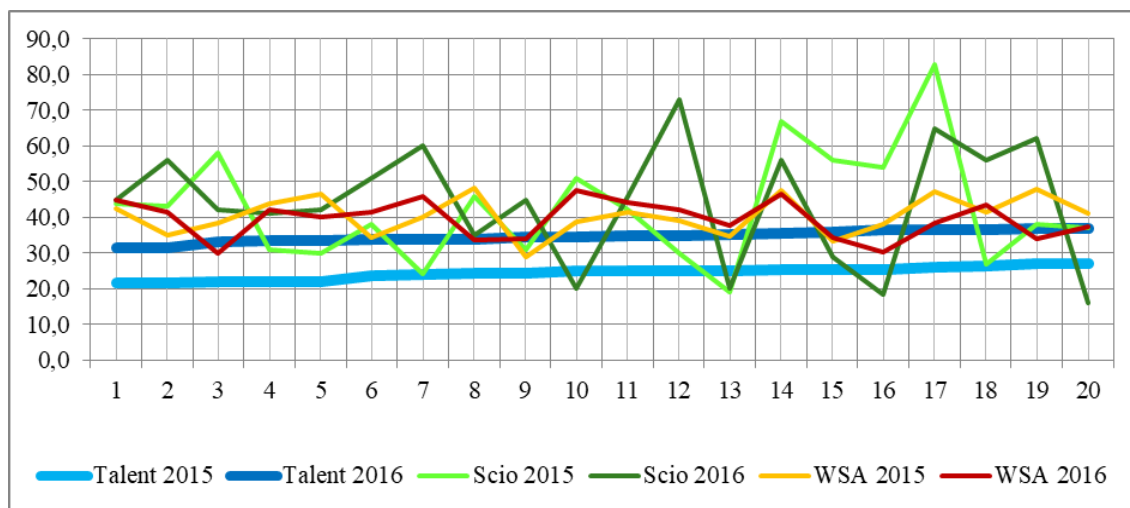


Figure 6: Relationship of study results for low success students on the talent examination.

Table 4: Students with low results on the Scio test.

Student (1-x)	Results of Scio test 2015	Results of Scio test 2016	Talent examination part 2015	Talent examination part 2016	WSA 2015	WSA 2016	WSA recalcul.*	WSA recalcul.*
1	14.0	14.0	35.5	60.5	1.91	2.19	41.8	36.2
2	15.0	14.0	50.0	37.5	2.27	2.48	34.6	30.4
3	16.0	14.0	45.0	49.0	2.28	1.97	34.4	40.6
4	17.0	16.0	47.5	40.0	1.78	2.53	44.4	29.4
5	17.0	16.0	37.5	37.0	1.66	2.13	46.8	37.4
x								
20	26.0	28.0	39.5	37.0	1.50	1.97	50.0	40.6

Note: * Recalculation of weighed study average (WSA) is given by $\{[10*(4-WSA)]*2\}$.

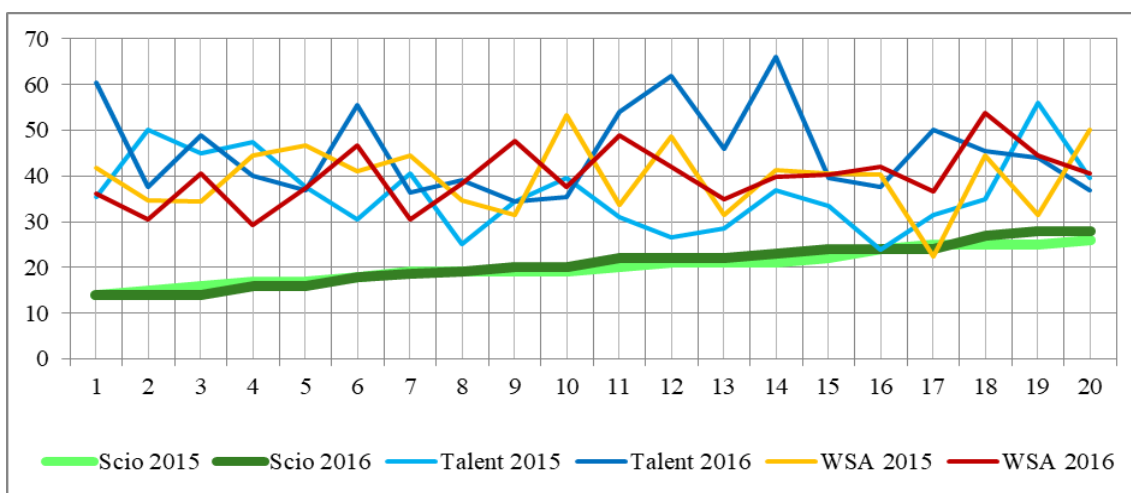


Figure 7: Relationship of study results for students with low values on the Scio test.

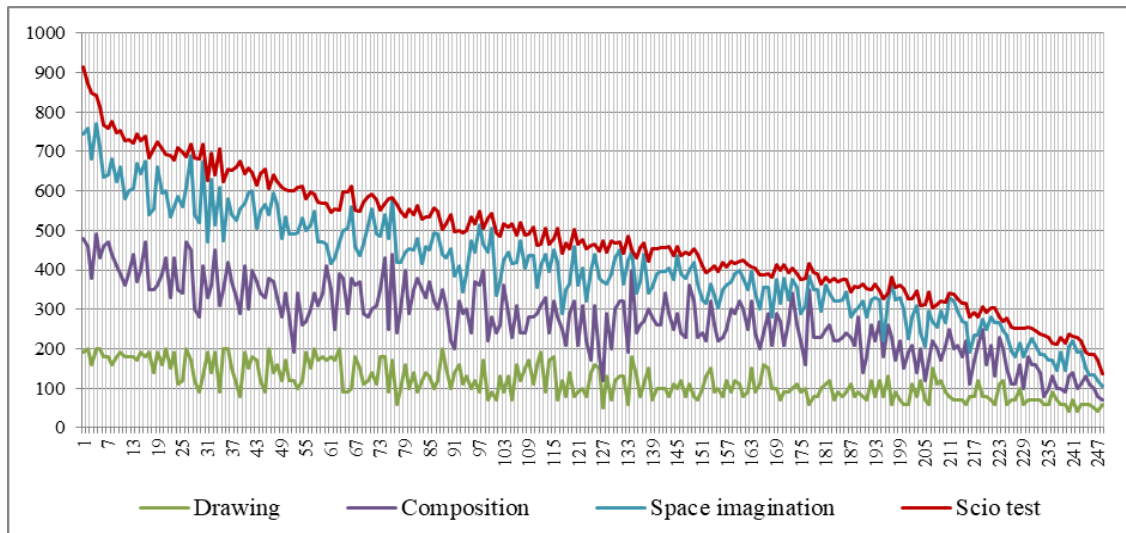


Figure 8: Success of applicants in individual tasks.

METHODOLOGY AND THE ADVANTAGES OF EXTERNAL EXAMINERS IN ASSESSING STUDY PRE-REQUISITES

Higher Level of Independence, Neutrality and Objectivity

External evaluation leads to a higher level of independence, neutrality and objectivity. *To know, perceive, understand...* is equivalent to the Latin word *scio*, and is associated with a famous quotation called the Socratic paradox. It appeared in Plato's account of Socrates: *scio me nihil scire* - I know I know nothing. At FA-STU, an external institution from the Czech Republic is partially used for the entrance examinations, to guarantee a neutral assessment of the abilities of applicants. Students perceive graduate-engineers as *intelligent, ambitious, responsible, quick-witted, clear thinking* and *curious* [14]. Scio entrance tests attempt to measure these qualities.

Applicants are tested to see if they have the basic abilities necessary for successful study at university. It is not a test of secondary school knowledge. The test has four equal parts [15]:

Verbal Part (Understanding Logic in Text)

Tasks in the verbal part, test abilities to work accurately in a language and to understand long texts. Level of working with information and information sources is determined, as well as the ability to find connections and to argue.

Logical Part (Logical Thinking)

Tasks in a logical part test the ability to deduce facts from a set of connected conditions. Tasks include working with information or data which could be delivered orally or graphically.

Argumentation Part (Reasoning to a Conclusion)

Tasks in the argumentation part search for a deeper ability to work with text as a basis for argumentation. This involves understanding a text well and to recognise subtle differences in its content. Tasks introduced here require a deeper analysis and working with a text as a whole.

Quantitative Part (Mathematical-logical and Creativity)

Tasks in the quantitative part test abilities to work correctly with quantitative data and to perform basic mathematical reasoning. This requires some mathematical knowledge used as a tool.

The external Scio tests in the entrance examinations at FA-STU have a weight of 0.2 out of 1.0. External judging of study prerequisites is an objective process for entrance examinations, whose benefits can be summarised as:

- fairness (uniform rules - results in harmonised percentiles);
- professional (level, procedures and demands of tests);
- transparency (open procedures and assessment);
- security (protection of personal data of applicants);
- versatility (choice of kind and place of the test);
- reliability of evaluation (high index of reliability - 0.905).

RESULTS OF THE RESEARCH

Persuasive Benefits

The research mirrors the objective reality of entrance examinations. They were evaluated by the hypothesis that the objectivity of the process of evaluation of entrance examinations has persuasive benefits.

Entrance examinations limit the black swan effect, as described by Nassim Nicholas Taleb in the book, *The Black Swan: The Impact of the Highly Improbable*. The authors do not want to accept candidates on the basis of the entrance examination only to have them fail during study. There is also the possibility of not accepting a candidate who might show potential for study only after its start. In short, mistakes may be minimised, but not completely eliminated. The effort is to help minimise the errors. Consider that the intuitive judgement of drawings, however honest, comes from a retrospective determination of how it has always been done. External objectification helps eliminate such subjective bias [16].

Considering entrance examinations and comparing their results with the success of study, lead to the following conclusions:

- comparison of results of individual tasks and conclusions showed the correctness of the research thesis;
- task 1 - drawing of a still-life was the least reliable predictor; it is probably a learned subjective process; it means everybody can master the task *with almost the same results* (see Figure 8);
- an important fact from the entrance examination was a high level of overlapping results on task 3 (spatial imagination) and task 4 (Scio test) (see Figure 8);
- correlation of results between general prerequisites for study and talent at visual drawings also shows extremes (exception proving the rule);
- comparison of results showed students with a high level of success at entrance examination and good study results had the Scio tests as a better predictor than the results of the talent examination (see Figures 4 to Figure 7);
- students with a minimal level of success in the talent test show a weak connection to study results (see Table 5);
- external nature of the Scio test is important and the entrance examination at FA-STU should perhaps not be limited to only the current test.

Table 5: Comparison of overall study results.

Type of results	WSA by talent results		WSA by Scio results	
Evaluated year	2015	2016	2015	2016
WSA by MAX	1.85	1.65	1.68	1.73
WSA - average	1.75		1.70	
WSA by MIN	1.98	2.03	2.02	2.00
WSA - average	2.00		2.01	

CONCLUSIONS

Architecture is sometimes seen as the mother of art. An architect, deserving of the name, must add to the traditional three goals of architecture as expressed by the ancient Roman architect Vitruvian *...firmitas utilitas venus* (strength, utility, beauty), sustainability, be socially and environmentally appropriate and resistant to economic dictation. Presented in this article is an attempt to answer questions that have arisen over some decades at the Faculty regarding the entrance examination process:

1. Should the level of knowledge and skills be judged?
2. In judging, should the preference be to judge talent or the prerequisites for study?
3. It is necessary to separate what a student should gain during study from what they must know before study.
4. The general prerequisites for study are not guaranteed by the secondary school-leaving examination.

The entrance examination process is highly important for applicants, and is taken seriously by the management of the school. This is the reason why the management wanted to modernise the entrance examinations. The crucial questions include: Should the school be responsible for whom it accepts for study and has it the right to make this decision? All decisions which schools need to take are at the end a matter of the conscience of teachers and management, and affect people's destinies. The first quality in a candidate is attitude to study, in this case - architecture. There is great concern when making a borderline decision to accept or reject a candidate.

If the school makes the ability to judge the talent as a condition for entrance to the school of architecture, it should not forget architects without architectonic education - for example, Christopher Wren, Le Corbusier, Santiago Calatrava. Maybe there are candidates who are rejected but could succeed.

A message for conservative architects: a very postmodern, but popular quotation: ...*It's life Jim, but not as we know it* [17] ... it is an entrance examination, but not as we know it.

ACKNOWLEDGEMENTS

This article was prepared under the grant project KEGA, Grant No. 059STU - 4/2016.

REFERENCES

1. Ilkovič, J., Špaček, R. and Ilkovičová, E., Competency position of Bachelor's degree in education. *Global J. of Engng. Educ.*, 19, 2, 99-105 (2017).
2. De La Bruyere, J., *Charaktery*. Bratislava: Nestor, 41 (2002).
3. Silfverberg, D.V., Aniceto, C. and Orbeta, A.C. Jr, The Role of Entrance Exams in Academic Performance of Students with Low Socioeconomic Background: Evidence from the SGP-PA, 15 May 2018, www.psa.gov.ph/content/role-entrance-exams-academic-performance-students-low-socioeconomic-background-evidence-sgp
4. Schopnosti, nadání a talent. Investice do rozvoje vzdělávání, 10 May 2018, http://ivy.sgo.cz/zsv/pl/schopnosti_nadani_a_talent_pl.pdf
5. Coyle, D., *The Talent Code: Greatness Isn't Born. It's Grown. Here's How*. New York: A Bantam Book, 10-30 (2009).
6. Pusca, D. and Northwood, D.O., The why, what and how of teaching: an engineering design perspective. *Global J. of Engng. Educ.*, 19, 2, 106-111 (2017).
7. Avsec, S. and Szewczyk-Zakrzewska, A., How to provide better knowledge creation and diffusion in mechanical engineering: the DLSI as a vehicle. *World Trans. on Engng. and Technol. Educ.*, 13, 3, 280-285 (2015).
8. Szewczyk-Zakrzewska, A., Can creativity be taught? The case study of chemical engineers. *World Trans. on Engng. and Technol. Educ.*, 13, 3, 382-386 (2015).
9. Alexy, A., Open Design Studio. DAAD 2018 Dni architektúry a dizajnu. Boomboom, 32-33 (2018).
10. Klíčové údaje o vysokém školství v Evropě. Ústav pro informace ve vzdělávání, Praha (2008), 10 March 2018, <http://europa.eu.int>
11. Hatipoğlu, C., The impact of the university entrance exam on EFL education in Turkey: pre-service English language teachers' perspective. *Proc. Inter. Conf. on Teach. and Learn. Engng. as an Addition. Lang.*, Antalya, Turkey, 136-144 (2016).
12. Podolan, M., *Kniha citátov*. Bratislava: Marenčin PT, 717-718 (2014).
13. Špaček, R., Vitková, E. and Šíp, L., Architectural education at Slovak University of Technology in Bratislava. *Global J. of Engng. Educ.*, 18, 1, 6-15 (2016).
14. Szewczyk-Zakrzewska, A. and Avsec, S., The impact of engineering study on the development of self-stereotypes. *Global J. of Engng. Educ.*, 18, 2, 95-99 (2016).
15. Scio, 5 January 2017, <https://www.scio.cz/nsz/osp.asp>
16. Taleb, N.N., *The Black Swan: the Impact of the Highly Improbable*. New York: Random House, 366 (2007).
17. Asimov, I., Not as we know it. *The Chemistry of Life. Cosmic Search*, 9, 3, 1, 5 (1981).