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HOW TO EVALUATE TESTS, FOR EXAMPLE MCT

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For many years and in various departments at the Geometry and Engineering Graphics Centre, Silesian University of Technology [4], as part of the first class of geometry or engineering graphics, an MCT (Mental Cutting Test – a multiple choice test) is performed. With the test, students can get to know their predispositions towards spatial imagination. Obviously the test, as opposed to its original function of qualifying for studies, when introduced by the College Entrance Examination Board (CEEB), in the Centre serves to encourage people with worse results to intensive work. It also indicates potential leaders.

Students evaluate themselves the tests they solved using the key indicated by the teacher. Before indicating the correct answer, students are asked which of the five answers is correct. And here, depending on the question, different answers are indicated as correct. In the case of some questions, the answers seem very similar and selection of the correct answer requires in-depth analysis.

MCT test was founded in 1939, when descriptive geometry was commonly taught in secondary schools, as evidenced by the scope of the then European and US textbooks [5,6]. The scope of textbooks included issues now introduced in college. It seems obvious that the knowledge possessed by a person subjected to the test at the beginning of its use was completely different than today. The current scope of geometry taught in primary and secondary schools only approaches to issues that were once commonly used.

Already a long time ago the idea has arose that, using tools such as remote education platform, to develop tests appropriate for the now required level of knowledge of people who begin technical studies.

Evaluating the newly prepared tests requires the development of new evaluation rules. Currently, one point is awarded only for the correct answer. It seems that even awarding part of a point for similar and partially correct solution is justified in the light of the geometric preparation of

persons undergoing the test. So the question arises, how to determine which answers should be awarded partially and which system should be adopted?

The authors decided first to use the division of allocated points made by experienced persons conducting classes in geometry and engineering graphics (10 years of teaching experience). Initially, the assumption was that teachers are to evaluate answers on a percent base and may award from 0 to 99%, because 100% is declared for the correct answer. It turned out that with such freedom teachers mostly accepted the model of 0%, 25%, 50% and 75%.

This paper includes data collected from 162 questionnaires from different years. The data has been subjected to analysis and corresponding simulations.

Table 1

MCT tasks (values in bold refer to correct answers) a) difficult b) easy

a)

No questions	answer				
	1	2	3	4	5
13	37.3	3.1	16.8	9.9	**32.9**
24	**35.5**	45.0	4.0	9.3	6.6
25	4	28.9	**26.2**	28.9	12.1

b)

No questions	answer				
	1	2	3	4	5
3	8	0	0	0.6	**91.4**
7	**66.3**	0	6,3	17.5	10.0
14	29.2	**46.0**	0	14.9	9.9

After entering the data, it turned out that questions 13, 24 and 25 were answered by students with more correct than incorrect answers.

In the light of the results in Table 1, these two questions can be considered difficult. For questions 13 and 25, the percent of correct answers was 32.9% and 26.2%, respectively. In the test there were also such answers that nobody in a given group has considered correct, therefore it can be considered that the incorrectness of the proposed answer was obvious to everyone. Thus, in this case it really was not a choice of 5. but 4 or even 3 answers.

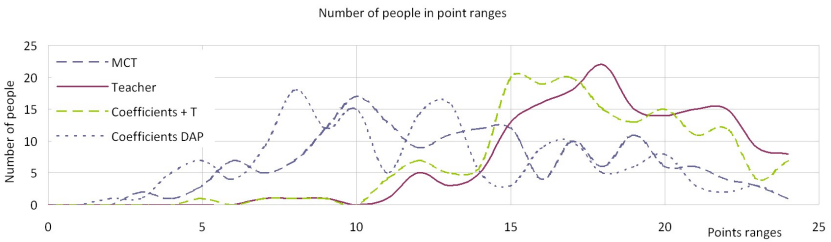

Fig. 1 Changes in score from the assessment method

There were carried out simulations of scoring distribution with various methods of evaluation. Figure 1 shows the chart for the number of people with a given sum of points. The x-axis shows ranges of the sum of points (at one point intervals), while the y-axis shows the number of people with the sum of points in a given range.

TCM is a traditional test evaluation, Teacher – the average of the percent division of points awarded by teachers, coefficient + T points taking into account the "difficulty" of task and division of points proposed by teachers, coefficient DAP – Divide All Points.

Points are awarded only for selection of the correct answer and their number is calculated. If a given task is correctly solved only by two people, the sum of points of all test participants awarded for this task is divided into two persons. This seems right because if the task is very difficult there should be more points awarded for solving it. And so the indication of the correct answer to question 25 is awarded 4.15 points, while questions 24 and 23 – 3.06 and 2.66 points, respectively, while the correct answer to question 3 is awarded only 1.1 points (the sum of points obtained is greater than 25, in order to compare the points were converted to the scale of 0-25 points).

Further methods of percent evaluation are based on the number of edges occurring in the correct solution and on the solution indicated. It works similarly with the drawn edges, the parallelism of the respective components and the squareness. These activities are designed to objectify the evaluation of already prepared materials and tests that the authors intend to develop. Development is to enable other persons to use the appropriate criteria for the evaluation of tests and tasks.

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