PROFESE ONLINE
peer-reviewed journal for non-medical health professions
ISSN 1803-4330
volume 9 / 1 • April 2016

I Know that I Know: A Certainty Based Marking Tests Designed for Evaluating Knowledge of Healthcare Students

Vít Blanař[1], Jan Pospíchal[2]

[1]Department of Nursing , Faculty of Health Studies, University of Pardubice, Pardubice, Czech Republic
[2]Department of Clinical Subspecialities, Faculty of Health Studies, University of Pardubice, Pardubice, Czech Republic

ABSTRACT

Background: The presented method of evaluating computer tests is based on the requisite to reduce the risk of guessing the correct answers while testing a large number of Healthcare students. The system guides students to realize their own mistakes and deducts points for their mistakes made unconsciously.
Aim: To compare the suitability of a method dealing with the certainty based marking tests in contrast to the tests without correction of guessing the correct answers while marking the knowledge of students of health studies.
Methods: 150 students undertook a test evaluating their level of knowledge from anatomy which is taken on regular basis. This test had a form of 40 computer evaluated dichotomous tasks with the correction of guessing the correct answers with a degree of certainty. The results were recalculated for correction using a negative marking and for results without correction.
Results: The average value of the difficulty of test items Q reached the level of 22.3. Yet corrected using the degree of certainty the outcome median was 49.2% of the required 70%. Without corrections the median was 77.5%.
Conclusion: This evaluation using the degree of certainty seems to be too strict for the students, however if the students actually had the required knowledge, they would have been more successful. A great benefit compared to other correction mechanisms designed for guessing is greater stratification of the results according to the number of mistakes made unconsciously and guessed answers.

KEY WORDS

Certainty-Based Marking, didactic test, evaluation system, nursing education, student, nurse

INTRODUCTION

An integral part of teaching health care students is evaluation of their knowledge. It enables us to verify the level of their mastery of material presented in lectures and applied during the student's work in a hospital. In the Czech Republic, oral examinations have been the „golden standard", which, when performed by experienced academic staff, usually maintain a high level of quality and complexity. However, oral examinations are time consuming, students tend to mindlessly memorize a plethora of information, and there is less objectivity if examiners change (1). Therefore, in the case of the evaluation of an increasing number of students, a high quality didactic test might be appropriate.

According to Chráska (2) a didactic test is an examination which focuses upon objective examination of mastery of the subject matter a by certain group of people. However, individual tests and test question differ in their difficulty and validity i.e. the correspondence of the test content with the objectives and content of the curriculum. Nevertheless, finding a suitable tool for a quick and efficient evaluation of students' knowledge might save time and energy. Another advantage might be ease of quantification, which would enable us to evaluate students objectively.

Individual tests used nowadays differ mostly in the number and type of test questions, or in the evaluation method. The ideal test form has to correspond to the objectives and content of the curriculum. It should also have a sufficient number of test questions, and the test should be undertaken under acceptable conditions, which should be the same for all students. Appropriate conditions include a quiet environment, sufficient time, no presented materials which would influence the students' results, and a seating arrangement which prevents cheating. When creating

test questions, we should focus on suitable usage of distractors, i.e., wrong answers, which should be neither too difficult nor too obvious. Another factor is a number of correct answers, the method of choosing or matching the answers, the time allocated to an individual test question, and the length of the instruction for an individual test question (3).

A frequently used type of test questions which verifies students' knowledge is a multiple choice question (MCQ). In this scenario, testees choose one or more answers out of the choices from a list. Other types include a single-best answer (SBA) and a multiple true/false question (MTF) i.e. a dichotomous test question. Among more modern test formats there are matching questions, or extended-matching questions (EMQ) (3, 4). The drawback of the above mentioned types is a danger of guessing correct answers, which we need to eliminate. Particularly with multiple choice questions, the risk is almost permanent.

A suitable option is using a score correction to decrease the influence of guessing on the test result itself. The phenomenon of „guessing", when a student chooses an answer without being sure or even just using a „wild guess", is widely spread, increasingly so with the popular usage of closed test questions (2).

Karp (5), as one of first authors, mentioned the risk of guessing in entrance examination for the Faculty of Medicine consisting of fifteen test questions. Depending on other variables, according to his research, up to 68% of applicants would be able to guess an answer in 1 to 8 test questions out of fifteen. 16% of guessing students would guess no answer correctly; nonetheless, 13.5% applicants would correctly guess 8 to 12 answers, and 2.5% would correctly guess as much as 12 to 15 answers. Traditionally, these tests use questions with four answers. Therefore, with the unchanged form of the test, a student is able to guess correctly each answer with 25% probability of success. In case the student manages to determine the easiest distractor, the probability of correct guessing reaches 33.3%. Moreover, with a test using MTF type of test questions only, the chance of success exceeds even 50% if the student chooses all answers as „True".

There are a number of correcting mechanisms, which should lower the impact of guessing the correct answer. The majority of these principles are based either on different ways to increase the difficulty of correct guessing or on a certain handicapping of the students who answer test questions incorrectly i.e. penalizing for mistakes. The principle of increased difficulty might work in the form of adding a higher number (e.g. five or six) distractors or increasing the number of correct answers for each test question. The disadvantage of this method is an increasing difficulty of passing the test as well as a more time consuming test. Simultaneously, creating the test becomes more difficult and the quality of distractors needs to be higher (6).

One method based on the principle of penalizing uses subtraction of points for wrong answers. Typically, a point is lost for a wrong answer where a point would have been gained for the correct answer. This method is called Negative Marking (NM). When taking a test using Negative Marking, a student that does not know the correct answer has two options; either to risk losing a point by incorrect guessing or skip the question and gain no points for the particular test question.

Another method, which we focus on in our research, is Certainty-Based Marking (CBM), which also uses subtraction of points but on the basis of a level of certainty indicated by the students themselves (7).

According to Chráska (1), another method called „a correction for guessing", which also uses the principle of penalizing, might be beneficial. This method can be used under assumption that a guessing student makes more mistake than a student who actually solves the test questions. In this case the correction subtracts a certain percentage of correct answers out of the total score depending on the number of wrong answers. The author also emphasizes the fact the students need to be informed „a correction for guessing" is being used in the test, so that they can leave certain test questions unanswered rather than risk penalty by incorrect guessing. This system might be unfair to students who do not guess and simply make more mistakes, because their points are subtracted anyway.

A Certainty Based Testing

The variant chosen by the authors of this work for improving knowledge testing to limit guessing is utilization of computer based tests using the method of Certainty-Based Marking (CBM). A level of certainty can be implemented in dichotomous test questions (true/false), matching, ordering, and multiple choice test questions. This method is not suitable for open questions because of limitations of computer assessment. Assessment using this correction might be implemented in the initial, progress, and final testing of knowledge of students of most fields.

The advantage of certainty based testing is to promote knowledge of students and to eliminate guessing in computer based tests using closed test questions. The test is most appropriate for the first two levels of Bloom's taxonomy (remembering and understan-

ding). However, it might be feasible to create a test for higher levels of Bloom's taxonomy and also implement a certainty based correction. A great benefit is the fact that the test includes self-assessment, and thus develops the skill of self-reflection in some students. Awareness of one's shortcomings creates an opportunity for improvement. Some students might use guessing unconsciously. They choose the correct answer believing they know the correct answer while they actually guess the most likely option and believe in luck. Successful guessing has no direct correlation to knowledge; therefore it is not advisable to assess students on the basis of guessing (7).

Visually, a CBM test question looks similar to a normal one, except the part where the student indicates the certainty they feel they know the answer with in a way of self-assessment. This directly influences the point correction for the particular answer. Figure 1 is an example of a dichotomous test question.

The system of evaluation is outlined in Table 1. The certainty, marked by a student, is converted into a percentage, and the point for a correct answer is multiplied by this value. The percentage value of added or subtracted points is a method based on research of Gardner-Medwin used at University College London for knowledge testing of students of medicine and biomedicine (7, 8). The result of each test question is modified according to the certainty marked by the student and whether they chose the correct answer. The option of result correction by CBM is available in LMS Moodle 2.1 and higher, and LAPT (London Agreed Protocol for Teaching) (9). The respective levels of certainty are labelled as quite sure (more than 80%), fairly sure (more than 67%), and unsure (less than 67%).

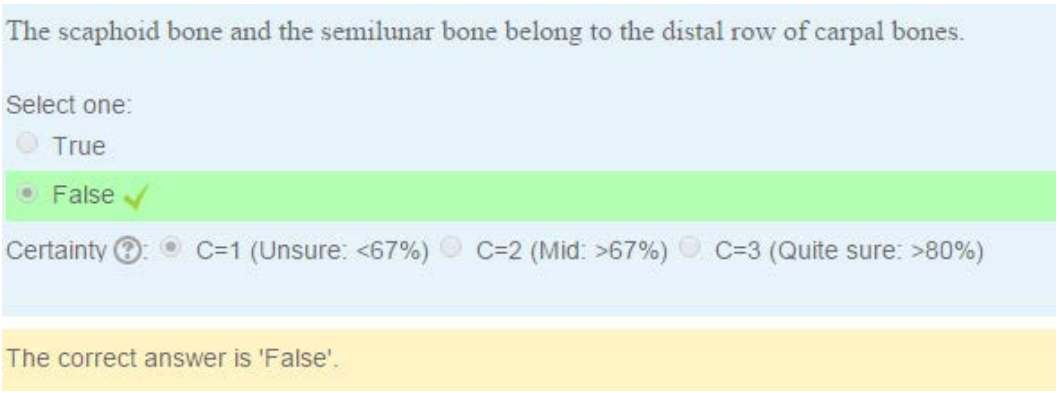
In case of a wrong answer the student loses points only when they chose the option of quite sure or fairly sure. The students are not motivated to skip questions, but to reflect their knowledge and to be able to realize they do not know the answer with enough certainty. Therefore wrong answers with marked certainty of unsure do not lead to subtraction of points. However, Table 1 clearly shows a significant loss of points in case of choosing a wrong answer with the certainty of quite sure. This penalty is based on the philosophy that it is not acceptable to make unconscious mistakes. A drawback of CBM is, nonetheless, a need of higher maturity of testees who would be able to assess their own knowledge in a critical way (7).

Examples from practice best elucidate the benefits of this system of testing. If a student is not sure, they can look for help and verify their procedure. If a student is *quite sure* 1 ml of Heparin contains 500 international units and thus would administer a tenfold dose to the patient, a penalty of two points in a test is highly relevant. The student would not pass an oral examination either. However, if the student realizes during his preparation they are not sure about the procedure, they can verify their presumptions. There is an equally urgent need to learn with certainty the subject matter of basic subjects. For instance, if a student is *quite sure* that „*sinister*" means „*right*" could lead to disastrous consequences in surgery where the correct site and side is paramount.

Table 1 Outline of assessment of questions in a certainty based testing

Certainty	Unsure	Fairly sure	Quite sure	No answer
Assessment of a correct aswer	33%	67%	100%	0%
Penalty for a mistake	0%	– 67%	– 200%	0%

Figure 1
An example of a test question with a certainty based correction



OBJECTIVES

To compare the suitability of the certainty based marking tests of students of health studies compared to tests without correction for guessing.

To compare the suitability of certainty based marking tests of students of health studies compared to correction using negative marking.

RESEARCH SAMPLE

The research sample consisted of 152 nonmedical students of health studies. All students were in the first year of their studies of General Nursing, Midwifery, or were training to be Paramedics. Two students did not complete all of the answers, and therefore, are not included in the results due to the impossibility of calculating test sensitivity.

METHODOLOGY

Piloting preceding the published results was carried out on a sample of 28 students in the above fields by the method of test and re-test using 20 test questions. Each student completed the test twice with a time interval of 15 minutes. A test with four options and one correct answer was chosen. The piloting verified the necessity of instruction before the CBM test. Instruction on the CBM system was carried out between the test and the re-test, and students did not have a chance to check the accuracy of their knowledge before the second test. The successive test (with a rearranged order of the test questions) correlated with the first test with a statistical significance of $p = 0.05$, but Spearman's nonparametric correlation coefficient was only $r = 0.677$. Moreover, after piloting, the number of test questions was increased from 20 to 40, and the test was made dichotomous with the aim of simplifying the completion of the test and avoiding ambiguity. Piloting took place in December 2014.

The research as such was carried out using a progress test in Anatomy. Students took the test in January 2015. The subject matter of the test was conveyed to all students by the means of lectures within the previous semester. Students were acquainted with the CBM test before the actual testing and could even try a sample test with 20 test questions, which, however, were not included in the evaluated test. This opportunity was taken by 132 students out of the total 152 in the research sample.

All testees underwent a computer based test with dichotomous test questions, complemented with a choice of certainty for each question. The test was the same for all students and consisted of 40 test questions. Individual tests had test questions arranged in different order, and the test questions were displayed in a secured window. Students had the option of free movement between test questions. The time limit was set at 30 minutes, which was based on the experience acquired during the piloting.

Test questions were based on the whole curriculum of the subject. Subsequently, the test questions were proofread by a team of four experts to eliminate potential mistakes and shortcomings. The test questions were not meant to be too demanding for the students. The test included six simple motivational questions, which students were supposed to answer with a high certainty, to encourage students to continue testing. Altogether 200 test questions created, out of which 40 were selected for the test itself by computer using pre-set criteria.

The test was password protected and posted on the intranet just prior to the beginning of the testing. The students were closely invigilated to prevent cheating. None of the students left their seats in the course of the test.

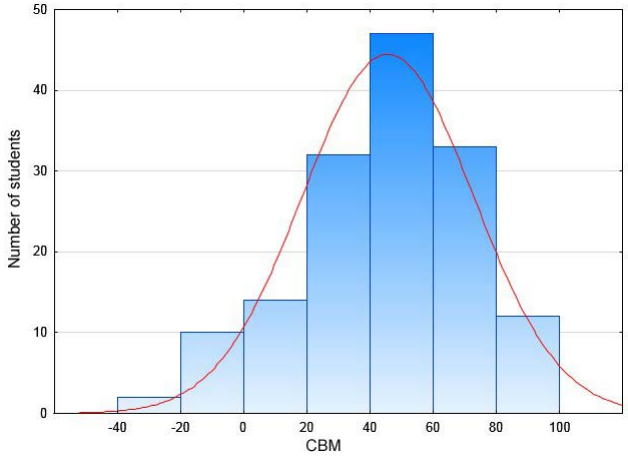
The evaluation was based on the assessment of the percentage of correct answers as proposed by Sedláčková (10), i.e. a very strict evaluation. Instead of using a scale, the tests were marked either *passed* or *failed*, corresponding to the interval between 70% and 100% of correct answers and below 69.9% respectively.

The test result without CBM correction was exported from the same text. The computer also produced the results for the Negative-Marking (NM), where a point is added for a correct answer and a point is subtracted for a wrong answer. All results were listed as percentages.

Test question difficulty Q is determined as a percentage of the overall number of testees who either failed or skipped the particular test question (2). It was calculated according to the formula $Q = 100\ (\frac{n_N}{n})$, where n_N is the number of students who did not answer the particular test question correctly, and n is the total number of students. The more difficult a test question was, the higher value of Q was reached (11). Sensitivity coefficient ULI is used for a calculation of capability of the test question to distinguish between students with higher and lower level of knowledge. It was calculated according to the formula $d = (\frac{n_L - n_H}{0{,}5n})$, where d expressed the value of the coefficient ULI, n_L is the number of persons in the group of students *wi*th a higher level of knowledge who answered the test question correctly, and n_H is a number of persons who also answered the test question correctly but belonged to the group of students with a lower level of knowledge (2, 12). To check for the reliability, Cronbach coefficient alpha was computed.

RESULTS

The CBM test in the progress test of the knowledge of anatomy was passed (passing mark 70%) only by 27 out of 150 students. The very same test assessed by the Negative-Marking would have been passed by 48 students. If there had been no correction for dichotomous test questions, the test would have been passed by 120 students. The average result of the CBM test was 45.1% with the median of 49.2%, the minimum -35.0% and the maximum 97.5%. The distribution of all the test results is displayed in a histogram (Graph 1). The average length of time to complete the test was 20.1 minutes.



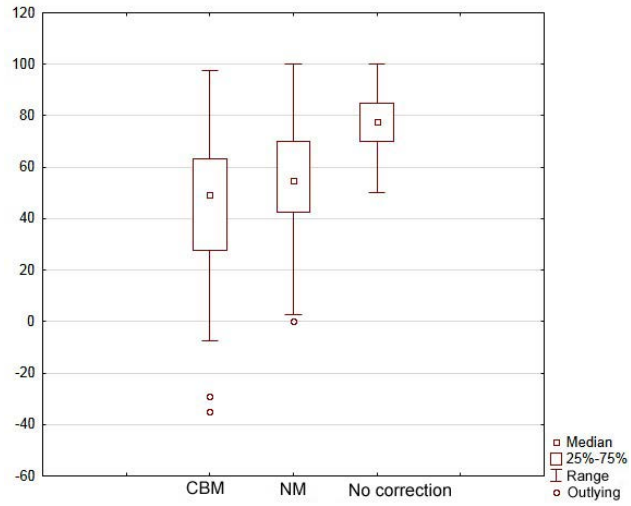
Graph 1 Results of CBM test shown in intervals of 20% points

The average difficulty of test questions Q reached the value of 22.3 with the minimum of 0 and the maximum of 48. Such a low value was caused by the choice of a simple form of dichotomous test questions. The test included six simpler motivational test questions. Their difficulty Q was lower than 5.

Using the sensitivity coefficient ULI, 23 test questions were marked as sensitive enough to distinguish between students with higher and lower levels of knowledge. As mentioned above, six test questions were only motivational and, as expected, did not have a sufficient sensitivity to indicate which students knew the subject well and did not guess. The sensitivity of the remaining eleven test questions was below the threshold for discrimination and therefore will not be used for further testing. The limit was set as $d \geq 0.25$ with the difficulty level Q = 30–70. For test questions with Q = 20–30 the limit was $d \geq 0.15$ (12).

A comparison of results of different alternative of using correction of guessing is displayed in Graph 2. When using the simplest form of testing (dichotomous test questions), it is obvious that CBM is a good tool for stratification of student answers according to the number of unconscious mistakes or guessed answers. The NM system of assessment also differentiated students well, but it motivated students to skip questions without answering them.

It was proved that it is not possible to use a dichotomous type of test questions without any correction of guessing using absolute assessment standardization (a set passing mark of 70%). When using this type of test questions without any correction of guessing, even students with the worst level of knowledge achieved a success rate of 50%, which corresponds to almost random completion of the test without the knowledge of the correct answers.



Graph 2 A Comparison of individual alternatives of the dichotomous test

The estimate of the internal consistency was calculated using Cronbach's alpha. The group of students was homogenous regarding the lectured subject matter as all of them were students in the first year. The surroundings in which the students took the test was familiar to them. Tested subject matter was also homogenous. The result of Cronbach's alpha was 0.7, the test questions had a sufficient internal consistency.

DISCUSSION

The average difficulty of test questions Q reached 22.3. Chráska (1) recommends the value to be minimally 20; otherwise test questions are too easy. Ideally the value of difficulty should lie within the region of 50. Although the test questions were deliberately created with a low level of difficulty, the CBM assessment showed that the success rate of most of the students (50%) fluctuated between 27.5 and 63.3%. When

using the CBM assessment, the average success rate dropped from 77.8% to 45.1%. Nevertheless, even after the change of the assessment principle, the most successful students still achieved a high percentage score. The part of students who fluctuated between lower and higher quartile when assessed without correction were then less successful after the conversion.

Surprisingly, in our research the NM assessment proved to be more lenient than CBM in spite of the assumption that students who are not sure would mark their answer as *fairly sure*, and thus would risk losing only 67% of a point instead of losing 100% of a point using NM assessment when answering incorrectly.

It was proved that before CBM testing it is crucial to acquaint students with the principle of the assessment, and let them try completing the test e.g. in a mock test (13).

A significant element, which influences the results of the test, is the capability of adequate self-assessment in testees. The CBM method presupposes a certain level of maturity among the students, who should neither overestimate nor underestimate their knowledge. A lower self-esteem might cause a failure in students who would answer all test questions correctly, but marked all answers as *fairly sure*. This would result in a score of 67% only.

A balanced assessment might be acquired by lowering the passing mark by 4% to 66%, which would eliminate the influence of a lower self-assessment. In such a scenario, even students who had answered correctly but marked their answers as *fairly sure* would pass. In our research this would mean 7 more students passing successfully.

Another important point in a CBM test preparation is that there should be a reasonable number of test questions. With a lower number of test questions (e.g. 10) students cannot pass if they answer just one question incorrectly and marks it as *quite sure*. Instead of gaining 10%, 20% is subtracted, thus sending the student plummeting to the passing mark of 70%. Therefore it is advisable to use minimally 40 test questions in the test. The optimal strategy seems to mark 28 answers as *quite sure* and then answer the remaining 12 test questions as *unsure*. This would reduce the risk of losing points, but simultaneously, the student would be aware of the areas of the subject matter they have not learnt sufficiently. When answering 6 questions marked as *quite sure* incorrectly (and answering the remaining 34 test questions correctly) the student still reaches the passing mark of 70%.

Nowadays, the most preferred alternative to point correction is increasing the difficulty of the test questions themselves. A higher difficulty might be achieved by a larger number of distractors or using more correct answers. However, even such methods have their drawbacks.

The disadvantages of using a simple test with one correct answer (out of six) are also described by Kubinger (6). In his study, such a test was compared to a test with two correct answers and three distractors. Although his study was carried out with 8th grade students, he generalizes his conclusions and does not recommend using simple tests with one correct answer. For a sufficient increase of the difficulty there have to be at least two correct answer and three to four distractors. Another drawback arises here which is the fact that creating such questions is more demanding and also reading the individual test questions becomes more time-consuming for a student.

The last option for increasing the difficulty of the test, and thus prevent guessing, is setting the passing mark higher, e.g. 80%. This method, however, is the least suitable, because it predominantly penalizes students who do not guess but simply make more mistakes. There is a lingering issue whether to try to eradicate guessing in tests completely. Vaughn (14) in his study based on four experiments does not prove better results for students learning by the method of a trial and error i.e. by repeated attempts to pass the test instead of classic learning of the subject matter.

In CBM testing, computing reliability is more demanding. The simplest and most frequent Kuder-Richardson's formula cannot be used as the students are not assessed for the same answer uniformly (15). Due to the allocation of only parts of a point, the calculation has to implement a split-half method or Cronbach's alpha coefficient (1, 16, 17).

Thanks to a certainty based marking we are able to use unambiguous questions with one correct answer and still prevent students from passing by guessing. Thus we can avoid using vague or intricately conceived test questions, which have to be used in the tests using several correct answers. Gardner-Medwin (7) published experience with dichotomous CBM on 345 students of Medicine at Imperial College, and summarized myths generally associated with CBM testing. This work describes implementation of the CBM testing in other fields than health care, and states the impossibility of defeating the system without knowledge of the testes subject matter. This is the work we have built our research upon. In Bereby-Meyer's study (18) on American and Israeli students with four experiments in a nearly identical CBM format, 27% test questions were skipped by the students in order not to lose points for a wrong answer. In our research only two students skipped questions; others used the opti-

on to mark their answer as *unsure* and thus lost no points for their awareness of a wrong answer. Karandikar (19) verified suitability of the tests with one correct answer using subtraction of points for wrong answers. A penalty of 33% of the point was used; however, a significant result was not reached. Therefore CBM testing uses a point deduction of 67% and 200% of the point value (i.e. two points) as recommended by Gardner-Medwin (7, 8).

LIMITATIONS

The low success rate of the test might be explained by the fact that this was a progress test, not a final test which would be a prerequisite to continue the studies in the successive semester. Therefore the students were not motivated enough to prepare sufficiently. Also, it was the very first test the students took during their bachelor studies. The found results might have been influenced by the students' previous experience from secondary schools (familiarity with electronic testing, difficulty of testing).

CONCLUSIONS

At the first sight, the CBM testing might seem a bit harsh; nonetheless, if they had mastered the subject matter, they would have been successful. A significant benefit, compared to other correction mechanisms, is a higher stratification of results due to the extent of unconscious mistakes and guessed answers. The system is particularly suitable for assessing mastery of key knowledge when testing large numbers of students. In addition, the system serves as a self-assessment and self-education tool. CBM testing proved to have dramatically decreased the success rate of the students who were not properly prepared for the test. Without the correction, students' results exceeded 50% using sheer guessing, which is a great threat to dichotomous test questions. Instruction about the CBM system before the test itself is crucial, as was clearly shown during the piloting stage.

REFERENCES

1. Chráska M. Didaktické testy. Brno: Paido; 1999.
2. Chráska M. Metody pedagogického výzkumu. Praha: Grada; 2007.
3. Štuka Č, Martinková P, Vejražka M, Trnka J, Komenda M. Testování při výuce medicíny: konstrukce a analýza testů na lékařských fakultách. Praha: Karolinum; 2013.
4. Slavík M. Vysokoškolská pedagogika. 1st ed. Praha: Grada publishing; 2012.
5. Karp J, Šafář Z. Kvizový způsob testování odborných znalostí středoškoláků při přijímacích zkouškách na lékařské fakulty. Sociologický Časopis. 1965;1(4):424-430.
6. Kubinger KD, Holocher-Ertl S, Reif M, Hohensinn Ch, Frebort M. On Minimizing Guessing Effects on Multiple-Choice Items: Superiority of a two solutions and three distractors item format to a one solution and five distractors item format. International Journal of Selection and Assessment. 2010;18(1):111-115.
7. Gardner-Medwin T, Curtin NA. Certainty-Based Marking (CBM) For Reflective Learning And Proper Knowledge Assessment. From the REAP International Online Conference on Assessment Design for Learner Responsibility [Internet]. 2007 May 29-30; Available from: http://www.ucl.ac.uk/lapt/REAP_cbm.pdf
8. Gardner-Medwin AR, Gahan M. Formative and Summative Confidence-Based Assessment, Proc. 7th International Computer-Aided Assessment Conference, Loughborough, UK, July 2003. p. 147-155.
9. Nozica B, Carapina M, Stanicic O. Certainty based marking: The use of modified grading schema in multiple choice quizzes. In: 6th International conference of education, research and innovation; 2013 Nov; Seville, Spain, p. 2160-2165.
10. Sedláčková J. Diagnostické metody ve vyučování matematice. Olomouc: Univerzita Palackého; 1993.
11. Koníček L, Malčík M, et al. Hodnocení výsledků vzdělávání – praktická část. Ostrava: Ostravská univerzita v Ostravě; 2007.
12. Jeřábek O, Bílek M. Teorie a praxe tvorby didaktických testů. Olomouc: Univerzita Palackého; 2010.
13. Cisar S M, Cisar P, Pinter R. True/false questions analysis using computerized Certainty-Based Marking tests. Intelligent Systems and Informatics,. SISY ,09. 7th International Symposium; 2009 Sep 25–26; p. 171-174, doi: 10.1109/SISY.2009.5291171.
14. Vaughn KE, Rawson KA. When is guessing incorrectly better than studying for enhancing memory? Psychonomic Bulletin & Review. 2012;(19):899-905. doi 10.3758/s13423-012-0276-0.
15. Hrabal V, Lustigová Z, Valentová L. Testy a testování ve škole. Praha: SVI PedF UK. 1992;
16. Komenda S, Zapletalová J. Analýza didaktického testu a její počítačová podpora. Olomouc: Lékařská fakulta UP: 1996.
17. Chráska M, Kočvarová I. Kvantitativní design v pedagogických výzkumech začínajících akademických pracovníků. Zlín: Academia centrum; 2014.
18. Bereby-Meyer Y, Meyer J, Flaschner O M. Prospect

theory analysis of guessing in multiple choice tests. Journal of Behavioral Decision Making [Internet]. 2002;15(4):313-327. doi: 10.1002/bdm.417. Available from: http://doi.wiley.com/10.1002/bdm.417
19. Karandikar RL. On multiple choice tests and negative marking. Current Science. 2010;99(8):1042-45.

CONTACT DETAILS OF MAIN AUTHOR
Vít Blanař, Mgr.
Faculty of Health Studies
University of Pardubice
Studentská 95
CZ-532 10 PARDUBICE
vit.blanar@upce.cz