Open-book tests assessed

Heijne-Penninga, Marjolein

Summary

Open-book tests assessed: quality, learning behaviour, test time and performance

When designing educational programmes that support student learning, it is important that the learning objectives, curriculum and assessment are aligned. Assessment, in particular, drives students' learning behaviours and, consequently, influences study success. This thesis focuses on an assessment format that seems to suit current learning objectives and the problem-based learning (PBL) approach – the open-book test.

In **Chapter 1**, two important trends that influence (medical) curricula are discussed: 1) the body of knowledge that is growing and changing faster than ever; and 2) the increasing need to concentrate education on competences. The most frequently used closed-book tests are appropriate to assess core knowledge, which is defined as knowledge students are required to know by heart. Open-book tests, however, seem to be more suitable for assessing students' ability to manage a large amount of knowledge that is in line with learning goals formulated in terms of competences. Previous research on and expectations of open-book tests are discussed in this chapter. Obviously, more information is needed to improve and optimize the use of open-book tests in medical programmes.

In general, open-book tests are implemented to represent the professional setting and encourage deeper learning. In **Chapter 2**, the use of open-book tests is discussed as a means to handle the growing body of knowledge. Therefore, the body of knowledge as a whole is divided into *core knowledge*, which students must know by heart without the need for referral, and *backup knowledge*, which students need to understand and use properly with the help of references, if so desired. As a result, all tests of the Bachelor of Medicine programme of the University Medical Center Groningen comprise two subtests, a closed and an open-book test. The closed-book subtest assesses the recall and understanding of core knowledge, and the open-book subtest assesses the ability to understand and manage backup

knowledge. We investigated the performance of first and second-year students from two cohorts (*N*=435 and *N*=449) on open and closed-book tests. Data from 14 tests were analysed using multilevel analysis, in accordance with the generalizability theory. The results showed that the use of open-book items alongside closed-book items was possible, without much decrease in psychometric quality. Students' scores in percentages were somewhat lower on the open-book tests; however, student ranking was almost the same for the open and closed-book sections. Therefore, open-book tests would be a useful addition to today's assessment programmes.

Assessment drives students' learning behaviours. In the literature, two learning approaches are consistently distinguished: deep and surface learning. Deep learning is seen as preferable for university students and can be described as focusing on understanding by applying and comparing ideas. High expectations of a positive influence of open-book tests on the level of deep learning are expressed. In **Chapter 3** we investigated whether these expectations are true. Second (N = 423) and third-year (N = 306) medical students evaluated their preparation for open and closed-book tests using the Test for Deep Information Processing. A paired *t*-test was used to analyse the data. The hypothesis that open-book tests stimulate a deep learning approach more than closed-book tests was not confirmed. On the contrary, the opposite was found: closed-book tests were more strongly related to a deep learning approach than open-book tests. Three possible explanations are discussed in this chapter: 1) deep learning might be particularly necessary for remembering and recalling knowledge which is especially necessary for closed-book tests, 2) students feel more confident when preparing for closed-book tests, and 3) students are more motivated to study for closed-book tests. It seems that if open-book tests have to stimulate deep learning, special attention to student confidence and motivation is required. However, taking the changing society into account, the question arises whether the traditional definition of deep learning is still appropriate and most preferable. Probably other ways of information processing and other variables might become more important.

This inspired us to examine how students' information processing strategies or learning approaches influence their test performance, which is described in **Chapter 4**. We included the deep learning approach *and* the level of need for cognition – the individual preference to engage in cognitive activities and information processing – in our study. The inter-relatedness of deep learning, need for cognition and preparation time, and scores on open and closed-book tests were analysed using LISREL. The results showed that students with a high need for cognition performed better on both open and closed-book tests (β-coefficients 0.05 and 0.11, respectively). Furthermore, test performance measured by open-book tests predicted closed-book test results better than the other way around (β-coefficients 0.72 and 0.11, respectively). Deep learning and preparation time did not influence students' performance. These results indicate that the need for cognition may be a valuable addition to existing theories on learning. In addition, adding open-book tests to the regularly used closed-book tests seems to improve the recall of knowledge that has to be learned by heart.

The study in Chapter 3 revealed that students prepared less deeply and in a shorter time for open-book tests than they did for closed-book tests. This outcome is in line with an often-expressed possible disadvantage of open-book tests: students' underestimation of test preparation. In **Chapter 5** we report on a study investigating whether students who use a deep learning approach need less open-book test time, and how students perform on open-book questions asked in a closed-book setting. Second (N = 491) and third-year students (N = 325) prepared half of the subject matter to be tested closed-book and half to be tested open-book. In agreement with the Board of Examiners, some questions in the closed-book test concerned open-book subject matter, and some questions in the open-book test concerned closed-book subject matter. Data were gathered on test time, deep learning and preparation time. Repeated measurement analysis, *t*-tests and partial correlations were used to analyse the data. The results showed that the deeper the learning approach second-year students used during open-book test preparation, the less open-book test time they needed. Students scored lowest on closed-book questions about open-book subject matter, and performed best on open-book

questions about closed-book subject matter. These results indicate that students should be encouraged to prepare in as much depth for open-book tests as they do for closed-book tests. Reduction of the available test time might force students to prepare longer and deeper.

The previously discussed chapters concentrate on test preparation, test time and, in particular, short-term performance. However, it is important that students are able to comprehend and apply the acquired knowledge, particularly in the long term. With reference to the cognitive load theory, we expected that a combination of PBL and open-book tests would result in better long-term knowledge retention. In **Chapter 6**, we report on a study concentrating on this expectation. Progress test results of first to sixth-year students participating in three different curricula were compared: a PBL curriculum using both closed and open-book tests (PBLob), a PBL curriculum using only closed-book tests (PBLcb) and a traditional curriculum using only closed-book tests (TC). In the PBLob setting, closed-book tests were used to assess core knowledge (essential for every professional) and open-book tests were used to assess backup knowledge (students must understand and be able to apply with the use of references). The results showed that PBL students performed significantly better than TC students on core knowledge in the long term, although the TC students outperformed their peers in the first two study years. The use of open-book tests negatively influenced short-term performance. In the long term, no influence of open-book tests scores on backup knowledge was found. Besides, students who were assessed with a combination of closed and open-book tests (PBLob) scored higher on core knowledge. Referring to the cognitive load theory, it seems likely that open-book tests, and especially PBL, stimulate schemata construction; in the long term, students profit from these schemata.

In **Chapter 7**, two important questions are disscused: *Why use open-book tests?* and *Why not to use open-book tests (solely or otherwise)?* The following reasons for seriously considering implementation are discussed: 1) open-book tests reduce the need for cramming and memorization, 2) a larger amount of knowledge can be

addressed in the same amount of time, 3) open-book tests stimulate teachers to ask questions at higher cognitive levels, 4) open-book tests suit the possible changes in students' information processing strategies, and 5) open-book tests fit the PBL approach. Besides, the previously discussed chapters showed that open-book tests are as difficult as closed-book tests and sufficiently reliable. They seem to positively influence the recall and application of core knowledge, and long-term backup knowledge was not influenced negatively by open-book test preparation.

Concerning the question why open-book tests should not be used, or not solely so, it is argued that current students in particular should be encouraged to develop deeper learning strategies, and that open-book tests do not appear to motivate the students to prepare properly. In addition, medical students are still expected to recall core knowledge immediately, which should be assessed by closed-book tests. The number of closed-book questions might be expected to decrease during the course of the medical degree programme(s). Furthermore, during the first years of medical training, closed-book tests are useful to teach students how to discriminate between main and side issues.

Finally, suggestions for future research are made; in particular, aspects related to the implementation of open-book tests – such as test time, teachers' and students' acceptance and the construction of open-book questions – need to be studied and improved.