

## University of Groningen

### Open-book tests assessed

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## Discussion



This research project was started due to two major changes in society: the growing and changing body of knowledge and a call for graduates to possess competences, particularly general competences such as information management and problem-solving skills. These developments have influenced the learning objectives of medical curricula and imply a need for changes assessment methods, because assessment drives students' learning behaviours and, consequently, learning outcomes.<sup>1-3</sup> Open-book tests appear to be better aligned with these learning objectives; however, more information was needed to improve and optimize the use of open-book tests. The five articles in this thesis add to the existing literature on several aspects of open-book tests and their relationships with factors such as student behaviour and performance, mostly in comparison with closed-book tests.

## **Why use open-book tests?**

Based on the results of our studies and on previous research there are several reasons to seriously consider the implementation of open-book tests in regular assessment programmes.

First, open-book tests reduce the need for cramming and the memorization of facts, thereby acknowledging that it is impossible for students to remember all medical knowledge by heart.<sup>4-6</sup> Moreover, some facts will have changed or been superseded by the time the students begin their professional careers. As the body of knowledge continues to grow and change, the way students manage this is becoming increasingly important. Open-book tests concentrate especially on handling and applying knowledge rather than remembering and recalling facts.

Second, when using open-book tests a larger amount of knowledge can be addressed in the same amount of time compared with closed-book tests. The relationships between various aspects of the body of knowledge become apparent to students when they are dealt with in the same educational unit. It seems likely that the use of open-book tests stimulates schemata construction when storing knowledge in the long-term memory. The studies reported in Chapters 4 and 6 are in line with this expectation; the results revealed a positive influence of the use of

open-book tests on *core* knowledge retention. These findings indicate that introducing open-book tests not only helps students to manage a large body of knowledge, but also seems to improve the retention of core knowledge, especially in the long term.

Third, open-book tests stimulate teachers to ask questions at higher cognitive levels. Questions that merely demand the reproduction of facts are not suitable, because students can simply copy the answers from the reference sources.<sup>7-9</sup> Open-book questions often start with a description of a case or problem and students then have to apply the information in the reference sources to address the case. Questions for which students need to combine information from different chapters or sources, are particularly suitable for open-book tests. For example, students may need to use a table or graph to interpret a case, or they may be asked to define the kind of problem or situation and provide a diagnosis. These kinds of questions make tests more academically challenging and better aligned with the learning objectives formulated as general competences.

Fourth, the open-book tests might not only be appropriate to current changes in society but also to today's students. Changes in contemporary society, in particular the development of digital technology, seem to have affected the information processing strategies of people.<sup>10</sup> Today, most students who enrol in universities have been exposed to the internet and other digital technologies from birth. Consequently, they have mastered these technologies, which determines the way they access and use information, and communicate.<sup>11</sup> For this reason, several educationalists and researchers have described these students as a new generation, giving them labels such as the Net Generation,<sup>10</sup> millennials,<sup>12</sup> generation Einstein,<sup>13</sup> or generation Me.<sup>14</sup> Next to different labels, there is also a difference of opinion about the precise definition of this generation in terms of date of birth, which ranges from the early 1970s until the early 2000s.<sup>10,12,14-16</sup>

Despite these differences, all of the authors attribute specific characteristics to the members of this new generation based on the fact that they have all been exposed to digital technologies – especially the internet – for a long time. Examples

of such characteristics are: high familiarity with technology, a multitasking style, team-oriented, shallowness of reading, achievement-oriented, assertive and high self-esteem.<sup>10,12-14,16-19</sup> However, these descriptions were usually based on individual views and rarely supported by empirical evidence. Most studies focused primarily on how often students used the internet, where they had access to the internet and whether they liked using the internet for educational purposes. Studies that did focus on the specific characteristics of the new generation confirmed the existence of these characteristics.<sup>17</sup> However, the population defined as the new generation appeared to be heterogeneous. In addition, the developments in digital technologies might also have affected other generations,<sup>17,20</sup> with exposure to technology seeming to be more important than age.<sup>10,20</sup> Whether these social developments are purely a generational phenomenon or associated with technology use, it still seems important to study and discuss the influence of such developments on students' preferences in relation to managing new information and learning. Instructional approaches should be closely aligned with the students' personal preferences with respect to learning and performing tasks, as this is likely to improve their motivation, meaning that they will be more engaged in learning.<sup>21,22</sup>

Developments in digital technologies seem to result in three student characteristics with respect to information processing.<sup>10,13,17-19</sup> First, students want to *control the information flow*. Today's students do not automatically read texts from beginning to end (sentence by sentence), but read in a non-linear manner.<sup>23,24</sup> Depending on the kind of information they need, they scan, speed-read or read closely. In addition, students enjoy multitasking. When studying, they want to decide whether and when they answer an e-mail or chat with friends, which information they need to answer a question or to solve a problem, and when and where to search for this information.<sup>10,13,17-19,23</sup> They are able to alternate attention quickly between these tasks. The non-linear information processing approach means that today's students are less likely to read books.<sup>14</sup>

Second, students want to *be (inter)actively involved in their learning* and have the opportunity to respond rather than just listening or reading.<sup>10,13,25</sup> When information is provided they want to ask questions or express their own views and

opinions. Today's students are familiar with an interactive approach, prefer immediate responses to their actions and are also achievement-oriented. When using digital technologies, every action is followed by a response from the computer. For example, when on the internet, clicking on a hyperlink brings up a new window with the linked text, picture or video, and when playing games, every key press results in a specific action. Therefore, students prefer to learn by solving problems and performing tasks and feel they learn better in an environment where they can teach themselves.<sup>10,25,26</sup>

Third, students *use networks as an important information source*. For example, they ask each other questions and share information in chat rooms, virtual communities and on discussion boards. They consider relationships and contacts important and like to work in groups in which they discuss problems and give responses in order to learn cooperatively with their peers. In particular, they enjoy talking with peers about things that really matter to them.<sup>10,25</sup> Moreover, they seem to absorb, process and share information quickly.<sup>13</sup>

Open-book tests seem to be in line with these student characteristics, since students have to solve problems or address cases (test items) and are allowed to consult reference sources to find the information they need to answer the questions. What kind of information they need and precisely when they decide to search their sources can vary between students.

A fifth reason to implement open-book tests is that they also seem congruent with a problem-based learning approach (PBL). PBL is an instructional approach in which students deal with problems in small groups supervised by a tutor. Discussions of these problems in small groups help students mobilize their prior knowledge concerning the subject and to make them aware of gaps in their knowledge and their learning needs. Students must conduct literature searches themselves to complete their knowledge about the subject.<sup>27</sup> This approach is in line with open-book assessment, during which students also become aware of the gaps in their immediate knowledge and use reference sources efficiently to resolve these gaps and answer the test items.

Thus, open-book tests suit developments in contemporary society: the growing body of knowledge, learning objectives formulated as competences and the possible changes in information processing strategies. They are also congruent with the problem-based learning approach. This makes them suitable as a complement to the use of closed-book tests. We also found that open-book tests are as difficult as closed-book tests and sufficiently reliable (Chapter 2) and long-term backup knowledge was not influenced negatively by open-book test preparation (Chapter 6).

### **Why not to use open-book tests, solely or otherwise?**

A problem with the above-mentioned characteristics of today's students is that they dislike reading books and texts from beginning to end. They 'zap' through the information rather than reading it entirely and do not develop a thorough understanding.<sup>10,17</sup> This might result in knowledge gaps and a superficial knowledge base. Reading and understanding all of the information is especially important for the construction of mental schemata in the long-term memory (as discussed in Chapter 6).<sup>28</sup> This indicates that current students in particular need to be stimulated to prepare properly and must be guided towards deeper learning strategies.<sup>19</sup> However, open-book tests have one major disadvantage: they do not stimulate students to prepare profoundly (Chapters 3 and 5).

In our curriculum, students prepared for open and closed-book tests simultaneously and each exam consisted of an open and a closed-book part. Our students were probably more motivated to prepare in greater depth for closed-book tests because they were aware that in this context they could not consult their references. During open-book tests, references can be consulted and students therefore probably thought they would be able to compensate for their poor test preparation by looking up more information for their answers. This problem might be due to allowing students too much time for the open-book test, meaning they were able to consult their reference sources frequently.<sup>6,29</sup> By shortening the length of time of an open-book test, students who prepare in a deeper way can benefit, as was shown in Chapter 5, these students were able to answer all of the open-book



questions in less time. Other students – who not prepare in a deep way – soon realize that they must prepare in greater depth to be able to complete the open-book test in time. In summary, current students in particular should be encouraged to develop deeper learning strategies, as open-book tests in themselves do not appear to motivate students to prepare properly.

Furthermore, there is core knowledge that medical students and professionals are expected to be able to recall immediately. The learning objective for this kind of knowledge is that students are able to reproduce this knowledge at any time and understand and apply it properly. For optimal student achievement, the learning objectives, the education programme and the assessment methods must be consistent and congruent.<sup>30</sup> Consequently, if the learning objective is knowledge reproduction, a closed-book test format is required. However, such tests should only assess the core knowledge required by all professionals and their number should be limited.<sup>31</sup> The quantity of core knowledge that students must acquire is greater during the first years of medical training than during subsequent years. It might therefore be expected that the number of closed-book tests decreases during medical training, resulting in solely open-book questions during the Master's programme.

It is important to note that even if only open-book tests are used, students must be able to recall some knowledge, so that they do not have to use sources for every detail and thus become pressed for time.<sup>32</sup> However, when preparing for an open-book test each student is able to decide individually which knowledge should or should not be learnt by heart. It is important that students learn how to distinguish between main and side issues in the first years of study. In summary, the sole use of open-book tests from the start of medical training seems unwise because there is a sufficient body of knowledge which students must be able to recall immediately and first-year students also need to be trained to discriminate between issues of primary and secondary importance.

## Further research

The studies discussed in the previous chapters of this thesis primarily concerned the perceptions and performance of students in a single medical school which used open-book tests from the first year of training. Further research is needed to determine whether these results can be replicated in other educational settings and disciplines.

Additional research is needed on several aspects of open-book assessment that were not examined in our studies. First, it is important to conduct further research on the time allowed for open-book tests, because, as explained above, it seems to be an important factor influencing students' open-book test preparation.<sup>6</sup> Test time could be varied in such a way that an optimal relationship between the number of questions and the available test time can be determined. Once the variables that influence open-book test time are identified, we will be better able to determine how long it would reasonably take to answer an open-book question.

Second, in our studies we did not focus on the teachers' and students' levels of acceptance of the open-book test format. This acceptance is crucial for the success of an assessment format.<sup>33</sup> Teachers who do not consider open-book tests to be appropriate or feel insecure when creating open-book questions, will inevitably negatively influence the quality of open-book test items. In addition, when teachers are negative about open-book tests, students might also not take these tests seriously. The students' acceptance is also of importance and was discussed in an in-house programme evaluation report.<sup>33-35</sup> During three focus group sessions, students expressed positive opinions about the division of knowledge into core and backup knowledge, as 'one cannot know everything', although some students regretted this. Furthermore, students indicated that open-book tests are better able to assess understanding and the application of knowledge.<sup>35</sup> Further research should focus on students' and teachers' opinions and their motivation for creating and constructing open-book tests.

Third, how teachers constructed open-book tests was not examined in our studies. While the teachers received written instructions about how to create open-book questions, it appeared that they each constructed questions differently,

according to the students, the questions differed in terms of the knowledge levels assessed, as well as their format and quality.<sup>35</sup> Future research should compare characteristics of open-book questions with those of closed-book questions and identify the training needs of teachers.

## Conclusion

It is important for educationalists and teachers to anticipate changes in society. Social developments influence the required competences of future physicians and, consequently, the learning objectives of the medical curriculum. However, changes in society might also influence student characteristics and student entrance levels with respect to several important competences, which in turn affects the educational programme. If medical curricula can anticipate social changes they will be better able to educate students to become competent professionals.

Open-book tests suit current developments in society and are also congruent with the problem-based learning approach. When they are used in combination with closed-book tests, they have a positive influence on core knowledge retention, while no negative influence of open-book test preparation was seen on long-term backup knowledge retention. However, aspects related to the implementation of open-book tests – such as test-time, teachers' and students' acceptance and the construction of open-book test items – need to be further studied and improved. As these aspects become clearer and students start to prepare in greater depth for open-book tests – as they do for closed-book tests – even more positive influences of open-book test preparation on short and long-term knowledge retention might result. This would make open-book tests even more indispensable when assessing all of the necessary competences required by future medical professionals.

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