

User Manual

Q1000 Cognitive Abilities



User Manual - Cognitive Abilities

Everything you need to know to get started with
Q1000 Cognitive Abilities (QCMV and QCHV)



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1. Q1000 Cognitive Abilities

1.1 Introduction

Q1000 Cognitive Abilities collects information about a person's cognitive ability (i.e. their general working and thinking level, as well as their verbal, figural, and numerical abilities). The test is suitable for adults who work or are looking for (new) work. Two versions of Q1000 Cognitive Abilities are available. The best version to use depends on the purpose and context of testing (e.g., the intellectual level required for a position). First, we will briefly discuss the theories around cognitive abilities and explain the advantages and disadvantages of taking tests with and without supervision. This is followed by an overview of the test versions and their areas of application.

1.2 Theoretical Basis: Cognitive Abilities

Below there is a brief explanation of the theoretical basis of Q1000 Cognitive Abilities. A detailed explanation can be found in the technical manuals that accompany the different versions - *Construction and Theoretical Background: Q1000 Cognitive Abilities High Level* (van Bebber, Lem-Silvester & van Zoelen, 2011), *Construction and Theoretical Background: Q1000 Cognitive Abilities Mid-Level* (Geertsma, van Leeuwen and Silvester, 2016), and *Construction and Theoretical Background: Q1000 Cognitive Abilities Shortened* (Geertsma, Silvester and van Leeuwen, 2021). These can be requested from our support department (support.nl@assessiobloom.com).

1.2.1 Intelligence

There are many theories on intelligence. Typically, they rely on one (or a combination) of the following definitions: (a) the ability to effectively cope/adapt to the environment (e.g. Colvin, in: Sternberg, 2000), (b) the ability to learn (e.g. Woodrow, in: Sternberg, 2000), and (c) the ability to think and reason abstractly (Cattell, 1971).

Intelligence, among other factors, shows a strong positive relationship with job performance. In fact, intelligence tests appear to have the highest predictive value among tests and selection methods in general. So, intelligence tests are good predictors of job success. (Hunter & Hunter, 1984) (Schmidt & Hunter, 1998).

1.2.2 G-factor

Most theories of intelligence assume that intelligent behaviour is based on one common factor. This is called the g-factor, also known as general intelligence or general cognitive abilities. The g-factor can be measured in various ways (Guttman, 1965; Horn and Cattell, 1966; Sternberg, 1985; Carroll, 1993; McGrew, 2009). In line with this idea, Q1000 Abilities makes a statement about general cognitive abilities (i.e., ACAP).



1.2.3 Content Dimensions

In addition, various theories are based on the content dimensions of intelligence. Both Guttman (1965) and Guilford (1967, 1971 and 1988) distinguish between figurative, verbal (or semantic), and numerical (or symbolic) skills. Others also use this distinction, such as Jager (1984) in his 'Berlin Model of Intelligence'. All versions of Q1000 Cognitive Abilities include questions about the three content dimensions of intelligence: verbal, numerical, and figural abilities.

1.3 What Does Q1000 Cognitive Abilities Measure?

Q1000 Cognitive Abilities measures general cognitive ability (ACAP). This refers to the ability to acquire new knowledge and/or apply already existing knowledge to new situations. Thus, the ACAP score is an indicator of someone’s general thinking and working level.

1.4 Overview of the Versions

Assessio Bloom offers cognitive abilities tests that can be completed at home, without supervision: QCHV (a higher-level version) and QCMV (a mid-level version). However, verification tests should always be taken under supervision. In addition, a candidate can take the test multiple times. The test is available for two levels (mid and high), corresponding to the thinking level required.

The shortened version does not require supervision and can also be made at home. Any additional verification tests should be taken under professional supervision. The verification test is a short test (15 minutes) that can be used to check the accuracy of the score obtained on the unsupervised test. If there is a large difference between the two results, the score on the unsupervised test is considered less reliable. The verification test contains the same components as the shortened test, but fewer questions. The test components are briefly described after this overview. The norm groups listed in italic are only indicative and not intended for selection purposes.

1.5 Overview of Each Version

Q1000 COGNITIVE ABILITIES MID LEVEL		
QCMV	Test component	Application
ACAP	Analogies	Available norms: MBO2/MBO3/MBO4 (HBO)
	Number Series	Administration: location of your choice, in combination with the verification test QCMC
	Diagrams	Verification test: under controlled conditions
	Figure Series	Administration time: 45 minutes , with an average of 34 minutes



Q1000 COGNITIVE ABILITIES HIGH LEVEL		
QCHV	Test component	Application
ACAP	Analogies	Available norms: HBO/VO
	Number Series	Administration: location of your choice, in combination with the verification test QCHC
	Diagrams	Verification test: under controlled conditions
	Figure Series	Administration time: 48 minutes , with an average of 41 minutes

Q1000 COGNITIVE ABILITIES VERIFICATION MID OR HIGH LEVEL		
QCHC/QCMC	Test component	Application
ACAP	Analogies	Available norms: equivalent to corresponding test
	Number Series	Administration: under controlled conditions
	Diagrams	Administration time: 15 minutes , with an average of 13 minutes
	Figure Series	

1.6 Description of Test Components

Verbal Abilities	
Test component	Definition
Analogies	Measures the ability to identify similarities between pairs of concepts and critically assess possible solutions. This skill is important in recognizing connections, seeing the bigger picture, and testing assumptions.
Diagrams	Measures the ability to represent the relationship between sets of concepts through images. This ability enables a person to quickly understand and apply general guidelines or rules.

Numerical Abilities	
Test component	Definition
Number Series	Involves discovering the rule underlying a series of numbers. Provides insight into the ability to recognize and apply numerical patterns. This skill is related to the level of abstraction that one can handle in the analysis and processing of numerical data.

Figural Abilities	
Test component	Definition
Figure Series	Measures the ability to identify the rules underlying a series of figures. This is important in interpreting figures or diagrams, but it also says something about a person's abstraction ability/analytical ability.



1.7 Areas of application

Q1000 Cognitive Abilities can be used for recruitment, career orientation, and employee development. The test can be used by a wide range of professionals, such as (selection) psychologists, career advisors, counselors, P&O advisors, trainers or coaches, reintegration experts, and intermediaries.

1.7.1 Recruitment and Selection

With Q1000 Cognitive Abilities you can determine what someone's general work and thinking level is. So, you can select candidates who meet specific job requirements. In a selection procedure, Q1000 Cognitive Abilities is often used in combination with other predictors, such as personality questionnaires, role plays, or interviews. These map out a person's competencies (effective work behavior). Q1000 Cognitive Abilities can also be used separately, for example, when a certain thinking level is a hard requirement for the position.

1.7.2 Career Orientation

With career orientation, you can use Q1000 Cognitive Abilities to see if someone has the necessary thinking level for a desired position or education. The cognitive abilities that a person possesses indicate how much effort it will take them to acquire new knowledge or to apply their current knowledge in new situations. By getting insight into their cognitive abilities, the person can focus on positions or educational programs that are suitable for their level.

1.7.3 Employee Development

With Q1000 Cognitive Abilities you can determine whether a certain level of functioning is feasible for an employee. Based on this, you can make a statement about the extent to which the candidate can grow into a certain job. This information can also help in the realization of personal development plans (e.g., to determine what are the best development steps to take). Of course, it is advisable to use Q1000 Cognitive Abilities in combination with other instruments, for a more complete picture of the candidate.



2.Q1000 Cognitive Abilities: Shortened and Complete Versions

Assessio Bloom offers two different types of cognitive abilities tests that we call *shortened* and *complete*. Both are suitable for making reliable statements about the general working and thinking level of candidates. The differences are explained in this chapter.

2.1 Composition

Q1000 Cognitive Abilities consists of various parts. Section 1.5 shows which components are included in each version, while section 1.6. explains what is measured by each component. The shortened versions consist of fewer parts than the complete versions. In the shortened versions, the emphasis is on the general reasoning components. All tests can (only) be administered on a computer.

Each version starts with a general explanation of the test. Each component starts with its own instructions. Because practice items are given for each component, the candidate can check whether they understood the instructions.

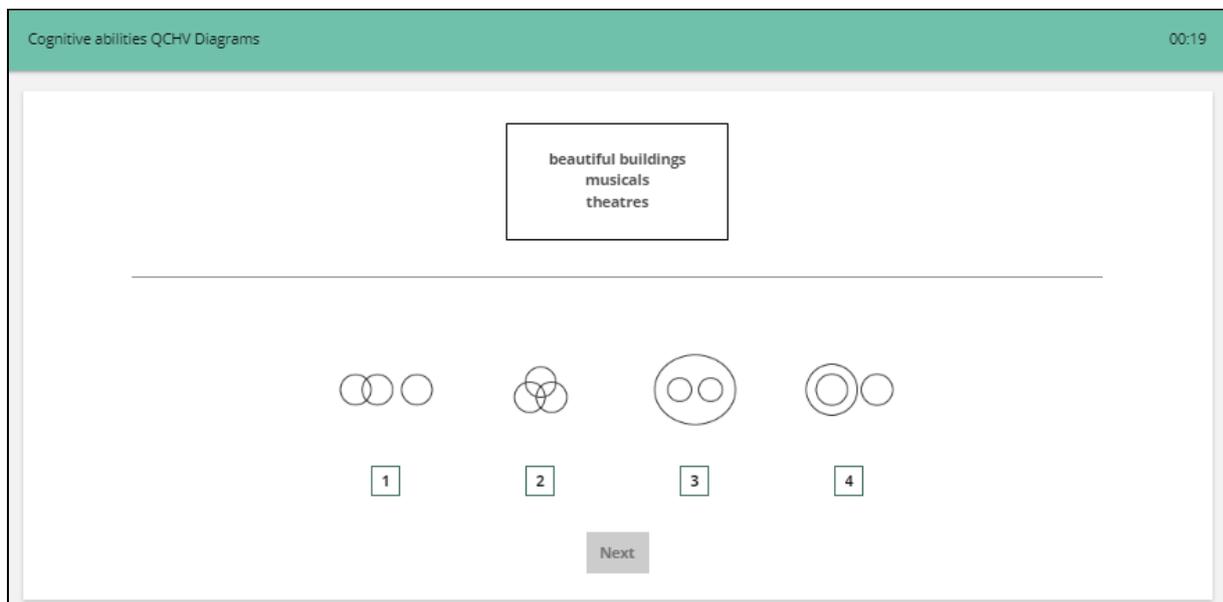


Figure 2.1: Example of a practice item for Diagrams. Which picture shows the relationship between the concepts?

The questions increase in difficulty. This means that each component starts with the least difficult questions. There is a time limit for answering each question. The candidate sees how much time is left. All questions have a multiple-choice format. Most questions have 4 answer options.

The shortened versions use questions from a so-called item bank are used, while the complete versions use a fixed set of questions. Working with an item bank means that each question is randomly chosen from a 'basket' of questions with the same level of difficulty. As a result, the content of this test is always different, so it is less susceptible to fraud. This



makes the shortened test better suited for taking in an unsupervised environment, such as at the candidate's home.

2.2 Theoretical Basis: Supervised or Unsupervised Tests

When test results are used to make important decisions, it is conceivable that some candidates might try to 'cheat'. This is especially when the test is taken unsupervised, and there is a smaller chance of being caught (Karim et al, 2014). Yet the number of candidates who attempt cheating is not very large. Research shows that the percentage of fraudsters is around 8% on unsupervised tests (Arthur et al., 2009).

Surveillance is the primary method for preventing fraud (Arthur et al., 2009). This ensures that helping tools that are not allowed are also not being used. The identity of the candidate can also be checked. However, monitoring is sometimes inefficient. Time, costs, distance from the testing location, and the availability of supervisors can play a role. For example, when the time frame for the selection examination is short, or the candidate's place of residence is far from the test location.

Research shows that the validity of supervised and unsupervised tests is comparable (Beaty et al., 2011; Kaminski & Hemingway, 2009). However, to keep the validity and reliability of the test equal to that of a supervised test, some measures must be taken (e.g., conducting verification tests and providing sufficient information to candidates).

Applying a verification test, or warning that it is possible to do so, deters and largely counteracts the tendency to commit fraud (Tippins, 2013). In addition, information is also important. Test candidates should know that the testing conditions (e.g., heat, light, and ambient noise) can affect their results (Weiner & Morrison, 2009). If the test is taken unsupervised, the candidate is responsible for ensuring proper testing conditions. Otherwise, this responsibility falls on the test supervisor. That is why it is important that candidates are well informed about this topic, for example, by means of an instruction brochure.

2.3 Supervision

Unsupervised testing has advantages and disadvantages. When a test is not administered in a controlled testing environment, this can affect the scores. For the candidate, it can be less stressful to take the test in their own, familiar environment. But unwanted influences can also occur, such as receiving help from third parties (e.g., friends or family members), using of (technical) tools such as calculators and search engines, being distracted by the telephone or by roommates, experiencing technical difficulties on one's own computer, etc. It is important that candidates are informed about how to prevent negative influences when taking the test at home. This can be done by providing them with an instruction brochure (available on the platform).

When developing the tests, we also took some measures to prevent or reduce the impact of cheating. The test components for the shortened versions have been chosen in such a way that respondents have little benefit from the use of unauthorized tools, such as (online) dic-



tionaries or calculators. The questions do not require knowledge of specific vocabulary or formulas. Furthermore, candidates do not benefit from prior knowledge about the test, since the questions are randomly chosen from an item bank. Therefore, there is little overlap between two random test administrations. Due to these characteristics, the shortened tests are better suited for use in unsupervised environments (such as at the candidate's home) than the complete ones. However, it is not possible to check whether the candidate has taken the test themselves (and without help). Thus, shortened tests remain more sensitive to this kind of fraud. If the candidate is suspected of fraud, the validity of the test results can be checked by administering a verification test.

2.4 Verification Test

The verification test takes about 15 minutes to complete. It includes questions about the same components as the shortened tests. The verification test checks whether the score on the shortened test can be used for its intended purpose, such as a selection decision. It also checks whether there is reason to believe that the candidate's general cognitive abilities are different than the shortened test indicated. If the candidate performs significantly worse on the verification test than on the shortened test, this will be stated in the report. In that case, we recommend **that the candidate takes a second test (re-test), but under supervision**. The questions answered on the first test have been saved. The system takes this into account and chooses different questions for the re-test. The result of the second test/re-test can be used for making the decision (e.g. whether to hire the candidate or not).

No selection decisions should be made based on the verification test. The test is too short for that and only designed for control purposes - nothing more, nothing less. When the test is used for career advice (in the broadest sense), the candidate might be interested in getting a good idea about their own possibilities. Therefore, the test situation can be considered less susceptible to fraud, even if the candidate takes the test unsupervised. For this reason, a verification test is not always necessary in this situation. However, we recommend that you do this at random from time to time.

2.4.1 Score Differences between the Verification Test and the Home Test

When the Z-scores on the two tests are more than 1.124 standard deviations apart, this difference is considered large (see section 3.2 for an explanation of the scores). If there is such a difference between scores, there is reason to doubt the validity of the results on the home test. Thus, a re-test is recommended.

2.5 Administration Time

Candidates are given a certain amount of time for each test component ('time per assignment'). This differs per component. For example, candidates are given a maximum of 70 seconds to answer a statement in the Number Series test component. In contrast, the Diagrams test component gives them a maximum of 25 seconds to choose an answer alternative. The maximum time per question is indicated in advance. Once the candidate runs out of time, it will take 6 seconds for the next item to appear. The maximum number of seconds/minutes



has been chosen to allow the majority of candidates enough time to answer. Thus, we have tried to prevent the candidates from experiencing unnecessary time pressure.

The shortened tests (mid and high level) are more concise than the complete ones, both in terms of the number of test components and the expected administration time. When administration time is important, the use of the shortened versions can be an option. If the test is taken under controlled conditions, a verification test is not necessary. Administering the test at home can yield a lot of profit in a large-scale selection procedure with a tight schedule. This is because the candidate can decide themselves when to take the test, including during evening hours or weekends.

2.6 Statements about Different Dimensions

The complete version includes multiple components measuring each dimension of cognitive abilities. That is why it is possible to make a statement about each dimension. Therefore, candidates who take the complete test receive results for both general cognitive ability and each of the specific abilities that are part of that. The shortened versions contain less questions per component. Therefore, it is not possible to make statement about individual abilities. When decisions must be made based on candidate's verbal, figural, or numerical abilities, the complete version of the test should be used.

2.7 Re-test

By working with an item bank, no administration of the shortened version will be exactly the same. This makes the shortened version suitable for re-testing. A re-test means that the candidate takes the shortened test again. The complete versions are not suitable for this, because the candidate will be asked exactly the same questions.

Usually, a re-test is recommended if there is a large difference between the results of the home administration of the test and those of the verification test. There may also be other reasons for using a re-test. For example, if a candidate indicates that they have experienced many technical issues during the home administration, or other problems that may have adversely affected the scores. It is up to the user responsible to assess the need for a re-test. If you would like to consult with us on this matter, please contact our support department (support.nl@assessio bloom.com).

2.8 Test Level: Mid or High?

The user can choose between the mid-level test and the high-level test. To see which version is the most suitable for each education level, see the overview in section 1.5.

You can base your decision on the job requirement (the desired work and thinking level) or the educational background of the candidate. This depends on the situation. In a selection issue, aligning with the job requirements is more important. However, when the test is used for career counselling, the person's educational background is more relevant. Based on the



necessary or desired work and thinking level, you can choose the most suitable version of Q1000 Cognitive Abilities. However, a norm group must be available for this desired work and thinking level. More information on the norm groups can be found in section 3.2.3.

It is important to choose the right test for the right level. For example, Q1000 Cognitive Abilities **Mid-Level** is the right version to determine whether a candidate has an **MBO** working and thinking level. By contrast, Q1000 Cognitive Abilities **High-Level** determined whether a candidate has **HBO or WO** working and thinking level. The versions are optimized for the levels for their intended levels. This means that the questions have an average level of difficulty for the relevant level of education.

To compare candidates, it is important that all of them are given the same version of the test. So, if you decide on using the high-level version, all candidates should be assessed with this specific version.

2.9 Test Version: Supervised or Unsupervised?

In this chapter, we described and compared all versions of Q1000 Cognitive Abilities. But how do you know which test to use, and in what way? As a handy tool for this question, a flow chart has been made. This flow chart contains information on how to choose the right version and level (see Figure 2.1).



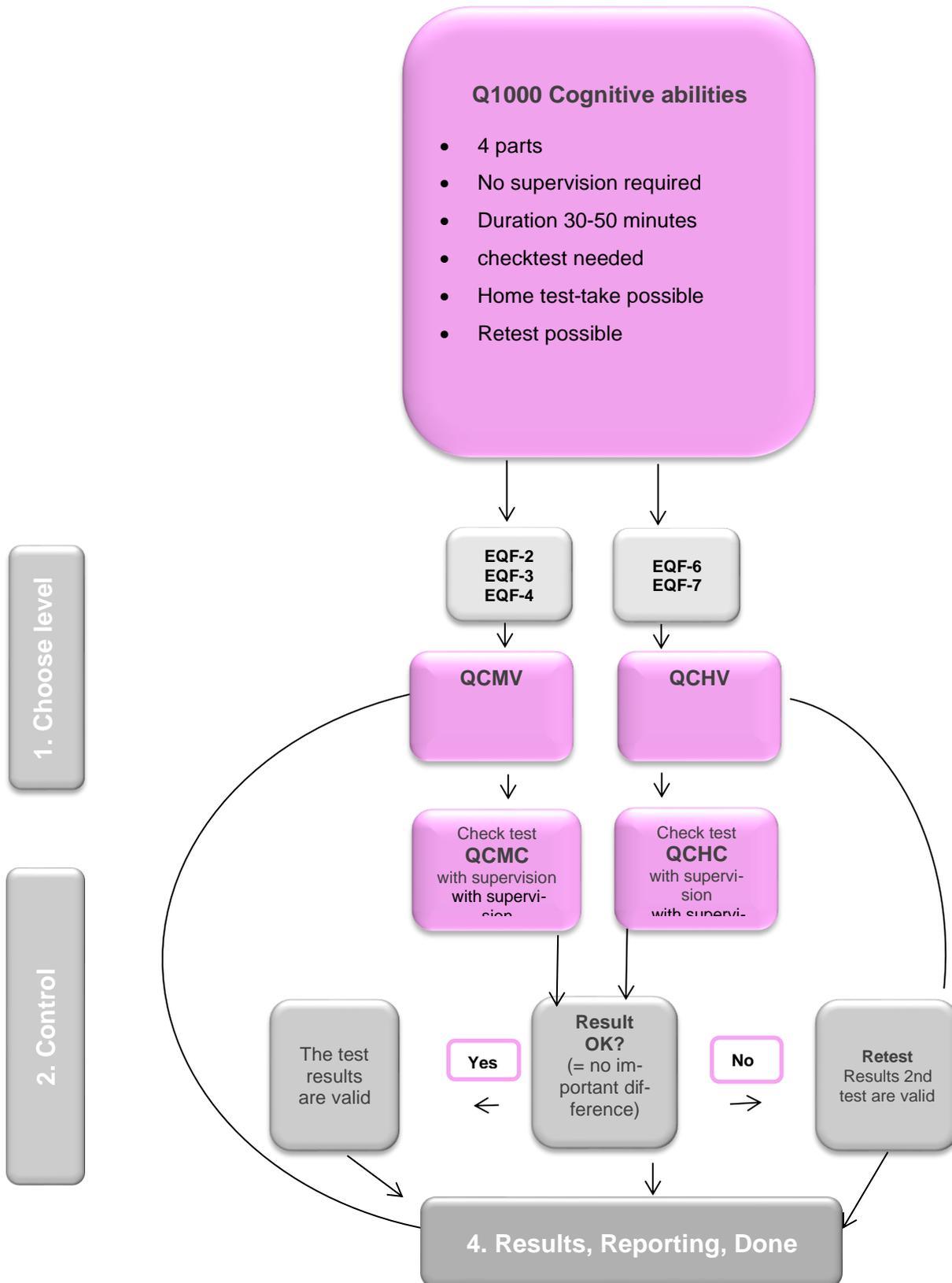


Figure 2.1 Flowchart level selection, control process.



3. Using Q1000 Cognitive Abilities

3.1 Test Administration

3.1.1 Conditions for Test Administration

As with any test, it is important that candidates can work under calm conditions. If the administration takes place under your supervision, you must ensure a pleasant and neutral test room, free of disturbing environmental influences (e.g., noise, cold, heat, telephones, people who enter unwanted). Disturbing environmental influences can affect a person's ability to concentrate. This can result in a lower score on the test. Because it is difficult to determine the precise effect of these influences, it is important to prevent them. If the candidate is feeling unwell, it is therefore better to make an appointment at another time.

What Is Needed for Test Administration?

Only a device with internet access **is required for the administration**. In principle, any device with internet access can be used, but we recommend using a computer, laptop, or tablet that is equipped with a **recent browser** (for example, Chrome, Firefox, Edge) and a sufficiently large **screen**. The questions are easy to read and the buttons on the screen are easy to operate. No experience with using computers is necessary.

3.1.2 Preparation of Candidates

We recommend that candidates read an instructional brochure related to Q1000 Cognitive Abilities prior to the testing day. This ensures that they can prepare for taking the test at home. ***This is necessary when it comes to at-home administration.*** Candidates must be informed about how to prepare and what are the best conditions for testing (see above). The instruction brochure also contains some example questions. As a result, candidates know what to expect and how to prepare. Instruction brochures can be found in the portal. Candidates are also given the opportunity to practice via www.oefenassessment.nl. In addition to example questions, this website also provides video explanations of the correct answers.

3.1.3 Instruction and Guidance

The candidate can find all the necessary information in the instruction brochure in advance, and the instruction screens during the test. Practice items are shown for each test component, so that the candidate can check whether they understood the instructions. Personal instruction is usually not necessary. However, in the case of supervised testing, we recommend that the candidate is supervised by an expert person. In Appendix 1, we give tips for guiding candidates on the testing day. The shortened versions are suitable for unsupervised Administration (i.e. in a quiet environment chosen by the candidate). In such a situation, it is extra important that the candidate reads the instruction brochure in advance.

The test is administered as follows:



1. The candidate received login details by e-mail. Using their preferred internet browser, they can access the page where they can connect to their e-portfolio.
2. The candidate fills in the username and password and follows the instructions in the e-portfolio. The test can be started by clicking on the 'Start' button or on the arrow.
3. The candidate reads the instruction for each test component.
4. The candidate reads and answers the example questions associated with each test component.
5. The candidate answers the questions for all components. If an unintended malfunction occurs (e.g. due to poor internet connection), the candidate can restart the test. All answers are saved. This means that previously answered questions do not need to be answered again. However, the instructions and practice questions will be shown again.
6. The candidate will return to their file as soon as they complete the test. The advisor can decide whether the candidate will be able to view their results immediately after the test or only after a personal discussion.
7. In case of a (temporary) problem with the internet connection, the test can be continued later. All previously given answers have been saved. The candidate will see all the instruction screens again. After that, they will continue from where they left off.
8. In case of other technical problems, the candidate or test supervisor can contact our support department. The contact details can be found on the login page.

3.2 Scoring and Standardisation

3.2.1 Scores

The test score is determined by the number of correct answers. For each correct answer, the candidate receives one point. The raw score for each test component is represented by the number of correctly answered questions. Based on the raw score of the components, the final scores (if applicable) and the total score (ACAP; general cognitive ability) are determined. The final scores refer to the scores on the dimensions Verbal Abilities (VCAP), Numerical Abilities (CCAP), and Figural Abilities (FCAP). Dimension scores are only available for the complete version (QCM and QCH). The total score (ACAP) is available for all versions. Both the total score and the scores per dimension are standardised scores (Z-scores). You can view the scores via the test results (i.e. click on 'Detail analysis') or via the report. In the report you will find a test description of the standardised scores. In 'Detail analysis', you can also find information about how the candidate answered the questions (i.e. which questions have been answered right or wrong and the response time per question).

3.2.2 From Raw Scores to Standardised Scores

Norms allow us to compare the test results of one person with the results of others. Thus, norms can be used to determine whether the candidate's score is high or low compared to a certain group. Suppose someone answered only a few questions correctly - is that good or bad? Knowing how most people answer the test gives more meaning to the score. Therefore, standardised scores provide insight into how someone's results compare to others. Our



norms are compiled based on the results of very large and representative groups of individuals who have completed the Q1000 Cognitive Abilities in the past. The test uses two types of standardised scores: deciles and Z-scores. Both can be found under 'Detail analysis'. In the report, results are displayed in Z-scores. In addition, scores are divided into five categories. Z-scores have an average of 0 and a standard deviation of 1. Deciles involve the classification of the scores into 10 groups of 10%. For more information about deciles and Z-scores, please refer to the manual Responsible Test Use Q1000 (Assessio Bloom, 2020).

3.2.3 Choose the Right Norm Group

It is important to choose the right norm group for your purpose. The MBO norm groups for the mid-level version and the HBO and WO norm groups for the high-level version are balanced and reflect the composition of the Dutch labour force at the relevant level. This helps us to make clear statements about the candidate's working and thinking level. An HBO norm is available for QCMV but use it with caution, because this norm group is not entirely representative of the target population. Thus, the HBO norm group is only suitable as an indication¹. If you have done an assessment with QCMV and you want to compare a candidate against an HBO norm, this test certainly gives an impression of their abilities. But if the test has been taken to support important decisions (e.g. personnel selection), we recommend that you always use the appropriate test level for the position. So, in this case, we would recommend QCHV.

Your choice must match the purpose of testing. The most suitable norm group depends on the situation. Sometimes, it can be useful to compare a candidate's results against different norm groups. For example, if a candidate scores above average on QCHV using the HBO norm, it might also be useful to compare their results against the WO norm. This can offer an indication of whether the person is able to acquire knowledge at a higher academic level.

3.2.3.1 Education Levels in the Netherlands and Associated Norm Groups

The norms offered have been chosen to match the working and thinking levels of the most common educational pathways in the Netherlands that provide a basic qualification. Specifically, these refer to courses that provide a basic qualification (i.e. after graduation, the person is considered capable of self-employment and qualified employment) (Ministry of Education, 2016). These pathways are: secondary vocational education (MBO), higher vocational education (HBO), and scientific education (WO). Usually, professions in the Netherlands can be assigned a specific working and thinking level based on the required prior education. Below, we give a description of all levels. We also provide a comparison with the EQF levels (i.e. the European Qualifications Framework, which was developed as a tool for translating, explaining and comparing diplomas obtained in different countries) (EQF, 2017).

MBO Level 1 (No Separate Norm Group)

MBO Level 1 is intended for young people without a diploma from a previous education. This training prepares young people for the labour market or for advancing to an MBO-2 education. Because this type of education does not lead to a basic qualification, QCMV does not have a separate norm group for MBO 1.

MBO Level 2 (MBO-2 Norm Group)



MBO Level 2 prepares students to do practical work (e.g., hairdresser or car technician). The norm groups for MBO-2 contain candidates who have completed education at this level (**EQF2**: basic factual knowledge of a field of work or study).

MBO Level 3 (MBO-3 Norm Group)

During MBO Level 3, one is trained to carry out independent work. Graduates are trained for professions such as caretaker or mechanic. The MBO-3 norm groups are composed of candidates with an MBO-3 diploma (**EQF3**: knowledge of facts, principles, processes, and general concepts in a field of work or study).

MBO Level 4 (MBO-4 Norm Group)

During MBO Level 4, one is trained to carry out completely independent work. Graduates can enter professions such as branch manager and activity supervisor. The norm group MBO-4 consists of candidates who completed education at this level (**EQF4**: factual and theoretical knowledge in broad contexts within a field of work or study).

There are two levels of higher education: Higher Vocational Education (HBO) and Scientific Education (WO).

Higher Vocational Education (HBO Norm Group)

Higher vocational education generally leads to a bachelor's degree (**EQF6**: advanced knowledge of a field of work or study, involving a critical understanding of theories and principles). The HBO norm group consists of people who completed education at this level.

Scientific Education (WO Norm Group)

Universities offer programs leading to a bachelor's degree or a master's degree. The WO norm group includes candidates who completed university education at master's level (Master, **EQF7**: highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research; critical awareness of knowledge issues in a field and at the interface between different fields).

3.2.4 Calculation of Norm Scores

For the complete versions (QCM and QCH), the total score (ACAP) represents an average of the Z-scores on the verbal, figural, and numerical abilities. All three dimensions have equal weight. The scores per dimension represent the average of the Z-scores obtained on the test components related to each dimension. For the shortened test versions, the total score (ACAP) is determined by averaging the Z-scores of the relevant components.

3.2.5 Graphical Overview of the Relationship between Scores

In the figure below you can see the relationship between the 'normal distribution', Z-scores, deciles, and the category scores used in the report.



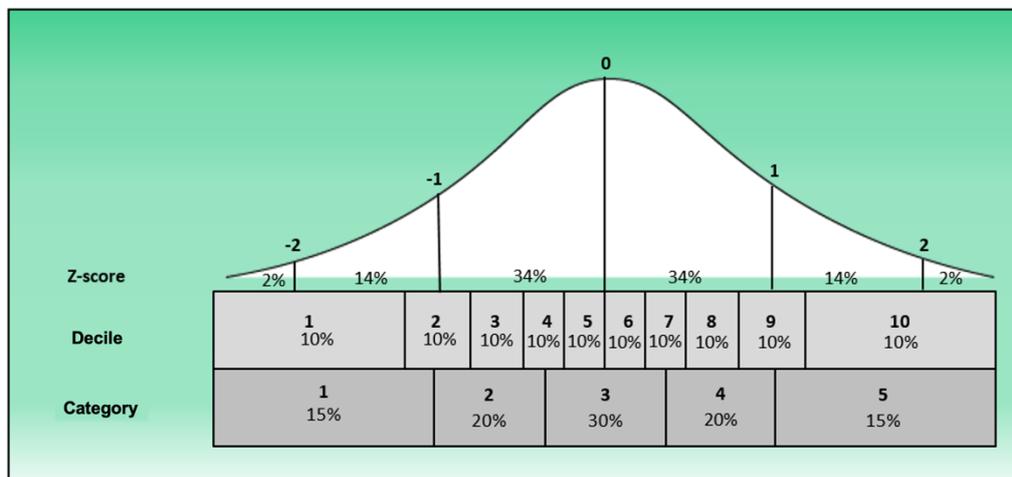


Figure 3.1: Normal distribution, z-scores, deciles and categories

3.2.6 Category scores

Q1000 reports use a five-point scale to represent a candidate's score on Q1000 Cognitive Abilities:

Category	Z-score	Percentage	From...until	Meaning
Category 1	< -1.04	15%	≤ 15%	Far below average
Category 2	-1.04; -0.38	20%	15% - 35%	Below average
Category 3	-0.38; 0.38	30%	35% - 65%	Average
Category 4	0.38; 1.04	20%	65% - 85%	Above average
Category 5	> 1.04	15%	≥ 85%	Far above average

Table 3.1: Category scores five-point scale Q1000

What do these scores mean?

1. The lowest 15% of the scores are **far below average**. This means that the candidate's score can be called low compared to others in the norm group. Therefore, the candidate will probably struggle to understand and acquire information at the desired level.
2. The next 20% of the scores are **below average**. This means that the candidate's score is moderate compared to others in the norm group. Therefore, the candidate will probably have some difficulty understanding and acquiring information at the desired level.
3. The next 30% of the scores are **average**. This means that the candidate's score is about as high as the average score in the norm group. Therefore, the candidate is expected to be able to understand and acquire information at the desired level.
4. The next 20% of the scores are **above average**. This means that the candidate's score is slightly higher than the average of the norm group. Thus, the candidate is expected to understand and acquire information at the desired level fairly quickly.
5. Finally, the top 15% of the scores are considered **far above average**. This means that the candidate scores higher than most of the people in the norm group. Thus, the candidate is expected to understand and acquire information at the desired level very quickly.

Note: The above terms can only be used to describe scores in relation to the chosen norm group. Results are often talked about in terms of 'sufficient' or 'insufficient'. This is something



you have to determine yourself by comparing the test results to the job requirements. In general, an 'average' level is sufficient for most positions. However, there are also exceptions. For instance, you might require candidates to have a strong HBO background for a certain position. Then, their scores on the high-level test should be above average. This means that a category score of 4 should be considered 'sufficient'. For another position, an average HBO working and thinking level might be requested. In this case, a category score of 3 would be considered 'sufficient'.

3.2.7 Confidence Intervals

Confidence intervals indicate the minimum and maximum value of a candidate's 'true' score. They are calculated based on the observed score, the psychometric properties of the test, and the chosen interval size. For more information on confidence intervals, see the technical manual and Lord & Novick (1968). The table below shows the confidence intervals for Q1000 Cognitive Abilities - High Level:

Q1000 Cognitive Abilities – High Level					
Dimension	Category Score	Z-score	Estimated True Score	Lower Limit (68%)	Upper Limit (68%)
ACAP	Average	0.00	0.00	-0.30	0.30
VCAP	Below average	-0.71	-0.62	-0.95	-0.28
CCAP	Average	0.00	0.00	-0.43	0.43
FCAP	Above average	0.71	0.62	0.12	0.96

Table 3.2: Q1000 Cognitive Abilities - High Level, Confidence Intervals

3.3 Interpretation

3.3.1 Required Knowledge and Expertise

How can you interpret the scores? First of all, it is important to have a thorough knowledge of the test. Therefore, the test should only be used by certified users. These are people who have followed a training course or successfully completed an e-learning module. The final objectives of this training are the following:

- The user can explain basic statistical and test technical concepts, such as reliability and standardisation;
- The user is able to explain the possibilities and limitations of the test and apply this knowledge in practice;
- The user understands the measurement pretension of Q1000 Cognitive Abilities;
- The user can interpret test scores based on the reports;
- The user is able to provide correct feedback to candidates based on the test scores;
- The user is able to make decisions based on the test scores;
- The user is aware of professional ethics rules and able to apply them in practice.

3.3.2 Understanding Dimensions and Test Components



The score on general cognitive ability (ACAP) can be used to make important decisions, such as hiring decisions. By adding the results on the three dimensions, you can get a more complete image of the candidate. For certain jobs, one dimension might be more important than the others. For example, visual abilities are important in jobs such as structural draftsman. Therefore, the score on Figural Cognitive Ability might carry more weight than the others. The position of junior policy officer is strongly relying on Verbal Cognitive Ability. However, this does not mean that the other dimensions can be disregarded. After all, every dimension is an essential part of general cognitive abilities.

The scores on the individual test components offer a more nuanced understanding of the results. However, they should not be given too much weight. Furthermore, no decisions should be made based on these scores. Nevertheless, it might be interesting to analyse them.

3.3.3 Combining Information

Cognitive ability is among the best predictors of performance (Schmidt & Hunter, 1998). Yet there are plenty of other factors that determine whether someone is successful at work (e.g., motivation, perseverance, discipline, or the ability to learn from experience). Scientific research shows that a combination of information sources can significantly improve prediction. For example, combining data from an intelligence test, a structured interview, and/or a practical simulation increases the accuracy of the results. This applies to both hiring and transfer decisions (Schmidt & Hunter, 1998). That is why it is good to use multiple tests to inform your decisions (e.g., Q1000 Personality or Q1000 Motivation). It is also useful to compare the results of the cognitive abilities test to the impressions of assessors who have interviewed the candidate or observed them in a role play.

If the candidate is motivated, and therefore willing to invest time and effort in their work or training, this will increase their chances of success. The same applies if the candidate has a genuine interest in what they are going to do. People put more effort into activities that they enjoy. Finally, it is important that the job or training suits the candidate. The more they match how they are (their personality) and what they can do (their competencies), the more successful the candidate is likely to be. Conversely, it is possible that a candidate with a lot of motivation and perseverance will still succeed in a position or training that requires a thinking level above their cognitive abilities. However, the chances of success are always higher for people with stronger cognitive abilities.

We have now provided some insights into how to interpret scores. In the appendix, you will find various case studies that can offer you a more in-depth understanding of the scoring system.

3.4 Feedback for Candidates

3.4.1 Different Score than Expected

Some test results might surprise you or the candidate. It is good to realize that the results do not always match the candidate's previous education or job level. There may be several explanations for this. For example, it is possible for a candidate who completed HBO education



to score above average compared to a WO norm group. There might be the case that the candidate had chosen an educational path that was not fully aligned with their cognitive abilities.

Conversely, there are also candidates with a university degree who, according to the cognitive test, score far below average compared to the WO norm group. It may be that these candidates were highly motivated for their studies and worked harder than their fellow students to achieve good results. Annex 3 presents a number of cases that further discuss the causes of some scoring profiles.

3.4.2 Disappointing Results

Often, it will come as no surprise to a candidate that, according to the test, they do not have a certain level of cognitive abilities. During their studies or work, the candidate might have noticed that they do not pick up new information so easily or that they have to work hard to meet the job requirements. Yet, it can also happen that the candidate does not recognize themselves in the results. In that situation, you can explain them the background of the cognitive abilities test. You can also search for things that stand out in the candidate's response pattern to find a possible explanation for disappointing results. You can't do more than give extra information and let the candidate express their disappointment. When the test is used for career advice, you can also emphasize that the candidate does not necessarily have to lower their ambitions in the event of disappointing results. If someone already has a lot of experience at a certain level or has certain personal qualities such as commitment and perseverance, they can probably succeed at that level. Moreover, it may be that the job description asks for a certain level of thinking, but that in practice this is not such a hard requirement.

3.5 Reporting

The report displays the ACAP Z-score and the category scores on the test components. The definitions of the test components are also displayed. The results of the test components are described in the report text. Various report formats are available. Most of them are fairly straightforward. However, we explain the competency report here because this is a combined report. This means that the results of Q1000 Personality are also included, along those of Q1000 Cognitive Abilities.

3.5.1 Competency Report

Competencies refer to general qualities that people display in work situations (Spencer & Spencer, 1993). The competency report is primarily based on the scores of Q1000 Personality. However, a person's cognitive abilities also contribute to some competencies. Therefore, the score of Q1000 Cognitive Abilities is also used to explain some competencies in the report. One example is the Vision competency. Specifically, a person's cognitive level influences their ability to analyse real events rationally and gain an overview of complex situations, relationships, and phenomena. Someone with high cognitive abilities is expected to put things into perspective. Thus, a high ACAP score has a positive influence on the Vision competency but does not determine it on its own. Certain characteristics, such as personality



traits, are also included. For instance, this competency is related to whether someone has creative ideas or an inclination to be innovative.

3.5.2 Saving the Report

You can choose a norm group for all report formats. The generated report remains available within the file for a limited period of time, but it can also be saved as a PDF report.

3.6 Possibilities and Limitations

It can happen that the results do not do justice to someone. For example, a person's age, cultural background, or language proficiency can negatively influence the results. Dyslexia can also give a distorted picture of a person's cognitive abilities. Therefore, you should always analyse the assessment critically – is the assessment useful given your particular goal or and circumstances? Some of the possibilities and limitations of the test are discussed below. Practical tips are also given.

3.6.1 Target Group

Q1000 Cognitive Abilities has been developed as a general-purpose tool for determining cognitive abilities. The test can only be taken by adults who work or are looking for (new) work. The study was also conducted on this target group. There is no data available on the use of Q1000 Cognitive Abilities in children, adolescents, the elderly, or people in a clinical setting.

3.6.2 Language and Culture

Due to its clear formulation, Q1000 Cognitive Abilities can be taken by people with different (cultural) backgrounds. The items of Q1000 Cognitive Abilities have been developed according to the guidelines of Hofstee (1991). This means that they are written in simple language, using common words. The use of jargon has been avoided. In addition, we have tried to create items that are suitable for a wide range of cultures. However, it is nearly impossible to have a completely bias-free test. One must take into account that a person's cultural background or language proficiency can influence their understanding of the test. In such situations, the results of the test can't be considered valid. Only candidates with sufficient command of the test language (i.e., higher than NT2, or B1 in terms of the Common European Framework) should be allowed to take the test. Candidates who do not take the test in their native language should also be cautious in interpreting the results.

3.6.3 Dyslexia and Dyscalculia

Dyslexia can affect the test results, but it is not easy to indicate to what extent. There are different forms and degrees of dyslexia. Therefore, the extent to which dyslexia affects someone's result can vary. In general, test administration is possible, as long as the limitations are taken into account when interpreting the results.



The influence of dyslexia plays a role in test components that involve reading. However, the questions are developed so that they can be understood without having to read much. The instructions require a bit more reading, but the candidate can take all the time they need to understand them properly. If desired and possible, the instructions can also be read aloud. For these candidates, it is extra important that they receive the instruction brochure, so that they can prepare well and practice in advance. Q1000 does not offer the possibility to extend the time available for answering each item. However, the instructions also include practice questions, so that the candidate can check whether they understood what they are asked to do.

There are also people who suffer from dyscalculia. Everything that applies to dyslexics also applies to them, except that they will also have difficulty with test components that include figures. Sometimes dyscalculia is also accompanied by reduced spatial awareness. This means that dyscalculia can also affect the results of test components such as Figure Series.

If you want to get a picture of how candidates with dyslexia will perform in practice, you should take into account that reading difficulties predict a lower performance in reading tasks. The same applies to candidates with dyscalculia and numeric tasks. However, it is difficult to get an accurate picture of the work and thinking level of these candidates. Take this into account when interpreting the test.

3.6.4 Age and Gender

In general, one should not expect to see gender differences regarding general cognitive abilities. However, it is possible to observe gender differences regarding specific skills or abilities (Hamilton, 2009). We also find some of these differences for Q1000 Cognitive Abilities. On average, men score slightly higher than women. In addition, having a strong measurement invariance has not been confirmed for QCHV's WO norm group. Therefore, we advise you to be cautious in the interpretation of small differences between an individual man and an individual woman. This does not apply to the other norm groups and levels, where this degree of measurement invariance has been demonstrated. Because it is a small effect, no correction has been applied. However, the composition of the norm groups is representative in terms of gender.

Finally, age can play a role in completing the tests. For most test components, older candidates tend to score lower than younger candidates. This is consistent with what is known from research about the influence of age on performance in cognitive tasks (e.g. Horn & Catell, 1966; McGrew, 2009). Intelligence stabilizes around 18 years old and remains about the same until somewhere between 55 and 65. After that, reaction speed and memory decrease, affecting the application of knowledge and reasoning ability. However, the age effects mentioned are small. These effects are not accounted for within Q1000 Cognitive Abilities. However, the composition of the norm groups is representative for the target population in terms of age, gender, and education level. When comparing groups of applicants from younger and older age groups, we recommend consulting the tables with 'effect sizes' in the technical manual.



3.7 Research Data and Accountability

A lot of research has been done into Q1000 Cognitive Abilities. In this section, we give a summary of the most important research results. The results relate to the main psychometric characteristics of a test: norms, reliability, construct validity, and predictive validity. The purpose of the research data below is to give an impression of the psychometric qualities of the instrument. More information can be found in the technical manuals.

3.7.1 Norms

The norm groups of Q1000 Cognitive Abilities are always recent. Our research department monitors our instruments carefully and regularly (i.e. several times a year). If necessary, we make adjustments to the norms based on our research. Thus, the norms are always up to date.

The data comes from a large number of customers. As a result, we have access to thousands of cases for the composition of our norm groups. We compile the norm groups according to the guidelines of the COTAN (Evers et al., 2009). This means, among other things, that we take into account the distribution of demographic variables (i.e. gender, age, industry) in the Dutch labour force. This information is available via CBS (EBB, 2008). Through sampling and weighting, the norm groups are structured to replicate the distribution of demographic characteristics in the target population.

3.7.2 Reliability

Reliability is one of the most important psychometric characteristics of a test. When a test is reliable, this means that it gives the same result if taken multiple times. When reliability is low, this means that measurement contains a large amount of error. In this case, the values will differ more from each other.

Reliability is expressed through a reliability coefficient. This is a number between 0 and 1. The reliability coefficient provides insight into the extent to which a measurement is independent of chance. The closer the reliability coefficient is to 1, the more accurate the measurement is. The COTAN assesses psychological instruments on the basis of their reliability, among other things. The COTAN states that a test or questionnaire must have a reliability coefficient of .80 in order to be suitable for informing important decisions.

The reliability of Q1000 Cognitive Abilities High (QCH) is good. ACAP has a reliability of .91 for candidates with a college education and .95 for those with a university education. The ACAP score for the Basic and Mid versions have a reliability of .94 (QCB) and .93 (QCM). The VCAP, CCAP and FCAP dimensions have a high reliability of the .80 for all three versions. For the shortened versions, ACAP has an overall reliability of .87 for Mid (QCMV) and .82 for High (QCHV).



3.7.3 Construct Validity

A questionnaire should not only be reliable, but must also be adequate for measuring the concepts it aims to measure. The construct validity of the different versions of Q1000 Cognitive Abilities have been investigated in different ways. Various analyses show that the internal structure of both the test as a whole and its components is in line with the chosen theoretical model.

The internal structure of Q1000 Cognitive Abilities is the same (i.e. invariant) regardless of participants' age or gender. Therefore, candidates are not disadvantaged on the basis of gender or age when making the test, although there is a minor influence of age on the test scores. For QCHV in particular, when comparing very young (-24) with older (55+) candidates, it should be taken into account that the average scores decrease with age. Thus, we recommend consulting the effect sizes in the technical manual for a more meaningful interpretation of the scores.

In addition, the average scores per scale for each education level are as expected (i.e. they are higher for people higher education). This provides further support for the construct validity. Another indication of the validity of Q1000 Cognitive Abilities is that the scales and dimensions are strongly correlated with the results of other instruments that measure intelligence, namely the GATB and Raven's Progressive Matrices.

Other indications of construct validity were also found, for example a significant correlation with the scores on an In-Basket test (MCS). The ACAP score also appears to be consistent with a technical/mechanical insight test used at a large employment agency.

3.7.4 Predictive Validity

Another important psychometric characteristic of a test is its predictive validity or predictive value. Predictive validity is investigated by comparing candidates' test scores with later job success, school success, or some other criteria.

The predictive validity of Q1000 Cognitive Abilities has been demonstrated in several studies. For QCH, one of these studies concerns the prediction of job success in a position of intermediary in the temporary employment sector. The VCAP and ACAP dimensions appear to be substantially related to several hard performance indicators for the function of intermediary. Another study on QCH concerns the relationship between the test scores and the salary level achieved by municipal officials in a medium-sized municipality. The test scores (ACAP, VCAP, CCAP) show a correlation with the salary level achieved.

The predictive value of QCM has been investigated at a large energy company, among others. The score on general cognitive abilities showed a significant correlation (.37) with the ICT proficiency certificate. In another study with QCM, physician assistants received simulated telephone calls for medical assistance for 30 minutes. The quality of their clinical assessment of the patient (i.e. as evaluated by expert trainers) was significantly related to ACAP.



The predictive validity of QCMV has been investigated on bus drivers, among other professions. A significant difference in ACAP was found between bus drivers who have been laid off or drivers who are still employed. Dismissed drivers appeared to score (much) lower on average.

For QCHV, the predictive validity was investigated by looking at the relationship between scores and peer reviews (360 Strengths). The strongest correlation was found with the assessment of Menta Strength. The predictive value of peer reviews has been demonstrated in meta-analysis studies (Schmidt & Hunter, 1998).

The different versions of Q1000 Cognitive Abilities have been positively assessed by the COTAN. Unfortunately, we are not allowed to include the review in this publication. The review can be only viewed by members (see <https://www.cotandocumentatie.nl/>). However, you can contact support.nl@assessiobloom.com for more information.



McGrew, K.S. (2009). CHC theory and the human Cognitive Ability project: Standing on the shoulders of the giants of psychometric intelligence research. *Intelligence* 37, 1-10

Schmidt, F., & Hunter, J. (1998). The validity and utility of selection methods in personnel psychology: practical implications of 85 years of research findings. *Psychological Bulletin*, 144, 262-274.

Sternberg, R. (1985). *Beyond IQ: A triarchic theory of human intelligence*. New York: Cambridge University Press.

Sternberg, R. J. , editor (2000). *Handbook of Intelligence*. Cambridge University Press.

Tippins, N. (2013) Technology and assessment in selection. *Organizational Psychology and Organizational Behavior* ,03/2013.

Weiner, J; Morrisson J. (2009) Unproctored Online Testing: Environmental Conditions and Validity *Industrial and Organizational Psychology*. 2, 1, 27–30.

