

Starting Cohort 3: Grade 5 (SC3) Wave 3 Information on the Competence Test

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Information on testing				
Test situation	Group testing, normally taking place in the classroom, 1 test instructor, normally 1 supervisory teaching staff			
Test sequence	The tests are held on two test days (in schools with L1-testing). On the first test day, all students take part in the sample. The tests are predetermined in four different sequences, depending on the difficulty of the reading competence test (“reading competence 1” or “reading competence 2”, depending on the study participants preload data; first tested students are predefined by random to one of the reading competence tests), as well as the order of mathematical competence and reading competence, followed by orthography and two versions of student questionnaires (initially interviewed vs. repetitive interviewed). On test day 2 students with migration background participated in the locator test for listening comprehension in the first language Russian and Turkish, followed by the competence test to listening comprehension Russian or Turkish (L1 test). Sequence test booklet 1 on test day 1: (TH 1A, 1B, 1C, 1D): mathematical competence+ procedural metacognition – reading competence 1+ procedural metacognition, reading competence 1 + procedural metacognition – mathematical competence+ procedural metacognition, mathematical competence+ procedural metacognition – reading competence 2+ procedural metacognition, reading competence 2 + procedural metacognition – mathematical competence+ procedural metacognition Sequence test booklet 2 on test day 1: Orthography + procedural metacognition (no rotation) Student questionnaire (Version A and B): Version A for Panel-Students, Version B for first interviewed students. Sequence test booklet 1 on test day 2: Russian or Turkish locator test, listening comprehension Russian or Turkish (L1)			
Test duration (net processing time)	Test day 1: 132 min (including student questionnaire) Test day 2: 33,5 min			
Breaks	Test day 1: 25 min Test day 2: approx. 5 min break after locator test			
Administration time	Test day 1: approx. 177 min Test day 2: approx. 50 min			
Information on the individual tests				
Construct	Number of Items	Allowed Processing Time	Survey Mode	Next Measurement (until 2013)
Mathematical competence	23	28 min	paper-pencil	After 2 years
Reading competence 1 or	29	28 min	paper-pencil	After 2 years
Reading competence 2	30	28 min	paper-pencil	

Orthography	137	30 min	paper-pencil	After 2 years
<i>Listening Comprehension Russian and Turkish</i>				
Russian or Turkish locator test	8	2,5 min	paper-pencil, given by CD	After 2 years
Russian or Turkish L1 test	34	28 min	paper-pencil, given by CD	
<i>Stage-specific procedural metacognition</i>				
Regarding the mathematical competence domain	1	2 min	paper-pencil	See above
Regarding the reading competence domain	6	2 min	paper-pencil	See above
Regarding the orthography domain	2	2 min	paper-pencil	See above
Regarding the Russian or Turkish L1 test	1	2 min	paper-pencil	See above

Preliminary note

The development of the individual tests is based on framework concepts. They constitute overarching concepts on the basis of which education-relevant competences are to be shown consistently and coherently over the entire personal history. Therefore, the following framework concepts that served as a basis for the development of the test tools to measure the above-mentioned constructs are identical in the different studies.

Reading competence

The ability to understand and use written texts is an important precondition for further developing personal knowledge and personal skills, and a prerequisite for participating in cultural and social life. Manifold areas of knowledge and life are made accessible through reading. The range of reading occasions is very wide, and reading fulfills many different functions (cf. Groeben & Hurrelmann, 2004). They range from reading for expanding knowledge which is crucial to further education and lifelong learning to literary-esthetic reading. Not only do texts convey information and facts, but they also transport ideas, moral concepts and cultural contents. Accordingly, the concept of reading competence in the National Education Panel takes functional understanding as a basis for reading competence, as is also reflected in the Anglo-Saxon *Literacy Concept* (also see OECD, 2009), with the focus on competent handling of texts in different typical everyday situations.

In order to represent the concept of reading competence over the entire life span as coherent as possible, three characteristic features were specified in the framework concepts for the NEPS reading competence test. They are considered in the following age and stage-specific test forms:

1. Text functions, text types respectively,
2. Comprehension requirements,
3. Task formats.

1. Text functions/text types

NEPS distinguishes between five text functions and associated text types which are represented in each version of the test: a) factual texts, b) commenting texts, c) literary texts, d) instructions and e) advertising texts. This selection is based on the assumption that these five text functions are of practical relevance to the study participants of various ages. The text functions and/or text types can be characterized as follows:

Texts conveying factual information represent basic texts for learning, fundamental acquisition of knowledge and extraction of information; examples are: articles, reports, reportages and announcements. Texts with a commenting function are texts in which a stand is taken or a controversial question is discussed and in which a reflecting level is integrated. This is where, for the study and adult cohorts, for example, ingenious essays or humorous comments are found; and where, in the student cohorts, the blessing and curse of smoking could be discussed. The literary-esthetic function of texts was included in the third category; here short stories and extracts from novels or stories can be found. As a

result of their specific reception that is presumably strongly dependent on educational track and curriculum, specific literary text types such as stage plays, satires or poems were excluded. The fourth category comprises text types conveying product inserts such as engineering and operating instructions, package inserts for medication, work instructions, cooking recipes etc. The fifth category (appeals, advertising) includes text types such as job advertisements, recreation programs etc (elaborately see Gehrer & Artelt, 2013). The five selected text functions and, thus, associated text types are realized as a longitudinal concept in each test booklet over the life span, which means that each test/each test booklet, for measuring the reading competence, contains a total of five texts corresponding to the five text functions.

Unlike the PISA studies, NEPS does not include discontinuous texts such as graphics, tables, road maps etc. Discontinuous texts are not contained in the NEPS concept as they pose high demands on readers and, in addition, are not significant for every age group for which reading competence is tested in NEPS.

Age-specific selection (text complexity, topic selection/task requirements):

For each age cohort, texts were and are selected according to thematic orientation and lexical, semantic and grammatical properties that have to be appropriate for the respective group of readers. By increasing text complexity (larger vocabulary, longer words, foreign words), increased complexity of the sentence structures) as well as the basic length of texts, the test design takes into account the increasing reading competence from childhood to early adulthood. In addition, texts are selected in order to ensure that topics correspond to the environment of the respective age group. This covers a wide spectrum of topics ranging from animals (for children) to social and philosophical questions relating to the meaning of life for adults. Additionally, the test material is adjusted to the respective age group through age-adapted phrasing of the questions, answering options and the comprehension requirements of the tasks.

2. Comprehension requirements / task types

From the literature on reading competence and text comprehension (e.g. Kintsch, 1998; Richter & Christmann, 2002), it is possible to derive different types of comprehension requirements reflected in the NEPS concept in three specific requirement types of the tasks (task types). The variants are called *types* as there is no explicit assumption that tasks of one type are necessarily more difficult or easier than tasks of another type.

For tasks of the first type (“finding information in the text”), detailed information must be identified at sentence level, in other words deciphering and recognizing statements or propositions. For tasks on this requirement cluster, the information needed to solve the respective tasks is, in terms of the wording, either contained in the text and identical with the task itself, or phrasing varies slightly.

In the case of the second task type (“drawing text-related conclusions”), conclusions have to be drawn from several sentences to be related to each other in order to extract local or global coherence. In some cases, this takes place between sentences located closely together, in others, several sentences are spread over entire sections. In another form of

this type, the task is to understand the thoughts expressed in the entire text, which requires the comprehension and integration of larger and more complex text portions.

For the third type, the requirements of “reflecting and assessing” are in the foreground, which in the literature is often linked to the mental representation of the text in the form of a situation model. In one version of this task type, the task is to understand the central idea, the main events or the core message of text, whereas in another version, the purpose and intention of a text has to be recognized and the readers are asked to assess the credibility of a text.

The different comprehension requirements occur in all text functions and are considered in the respective test versions in a well-proportioned ratio. (cf. Fig. 1.).

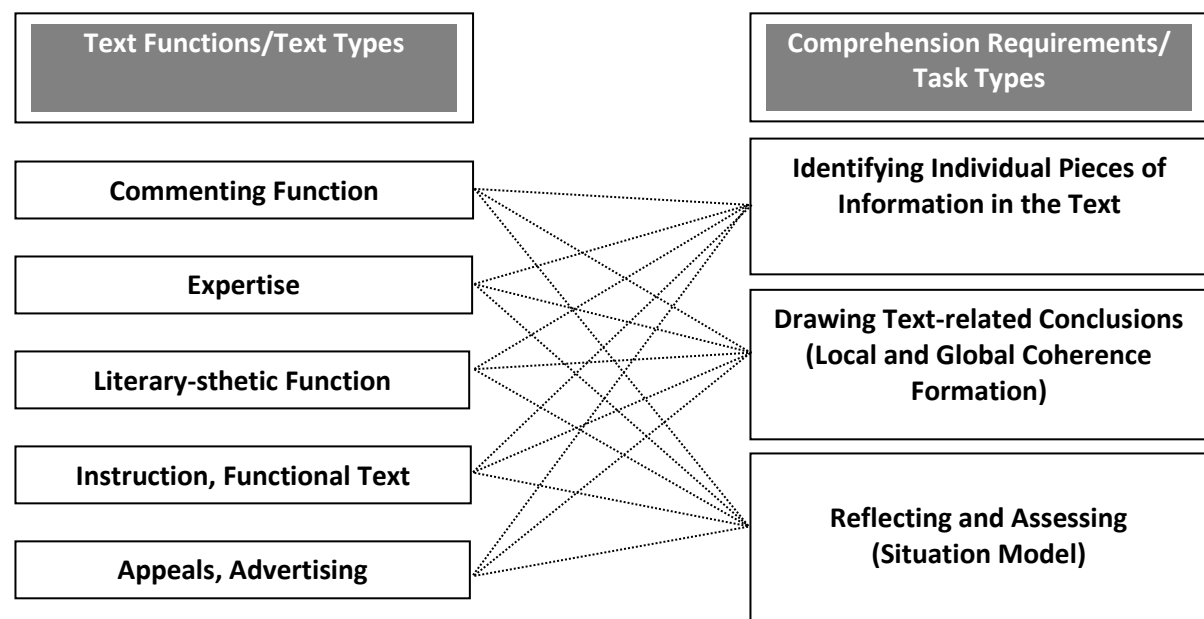


Fig. 1: Text functions and comprehension requirements

3. Task formats

The majority of tasks match the multiple choice format. Tasks of this type consist of a question/assignment on a text for which four different answers are offered, one of which is the correct answer. As another task format, decision-making tasks are used where individual statements have to be judged on whether they are right or wrong according to the text. The so-called correlation tasks represent a third format where, for example, a partial title must be chosen and assigned to different sections of a text. For tasks of the second and third type, summaries are made, if necessary, thus creating answers with partly correct solutions (partial credit items).

By systematically considering different text functions, which are implemented in different age groups in realistic and age-related texts, text themes and different comprehension requirements of the related tasks, it is possible to operationalize reading competence as a comprehensive ability construct (elaborately see Gehrler, Zimmermann, Artelt, & Weinert, 2013).

Bibliography

- Gehrer, K. & Artelt, C. (2013). Literalität und Bildungslaufbahn: Das Bildungspanel NEPS. In A. Bertschi-Kaufmann, & C. Rosebrock (Hrsg.). *Literalität erfassen: bildungspolitisch, kulturell, individuell*. S. 168-187. Weinheim, Germany: Juventa.
- Gehrer, K., Zimmermann, S., Artelt, C., Weinert, S. (2013): NEPS Framework for Assessing Reading Competence and Results From an Adult Pilot Study. In: C. Artelt/S. Weinert/C. Carstensen (Hrsg.), *Competence Assessment within the NEPS*. Journal for Educational Research Online 5(2), 50-79.
- Groebe, N. & Hurrelmann, B. (Hrsg.) (2004). *Lesesozialisation in der Mediengesellschaft: Ein Forschungsüberblick*. Weinheim: Juventa.
- Kintsch, W. (1998). *Comprehension. A paradigm for cognition*. Cambridge: University Press.
- OECD (2009). *PISA 2009 assessment framework – Key competencies in reading, mathematics, and science*. Paris: OECD
- Richter, T. & Christmann, U. (2002). Lesekompetenz: Prozessebenen und interindividuelle Unterschiede. In N. Groeben, B. Hurrelmann (Hrsg.), *Lesekompetenz: Bedingungen, Dimensionen, Funktionen* (S. 25-58). Weinheim: Juventa.

Mathematical competence

In the National Education Panel Study, the construct of *mathematical competence* is based on the idea of *mathematical literacy* as was defined, for example, in PISA. Thus, the construct describes “[...] an individual’s capacity to identify and understand the role that mathematics plays in the world, to make well-founded mathematical judgments and to use and engage with mathematics in ways that meet the needs of that individual’s life as a constructive, concerned and reflective citizen.” (OECD, 2003, 24). Regarding younger children, this idea refers to competent handling of mathematical problems in *age-specific contexts*.

Accordingly, mathematical competence in NEPS is operationalized by items assessing more than pure mathematical knowledge; instead, solving the items requires recognizing and flexibly applying mathematics in realistic, mainly extra-mathematical situations.

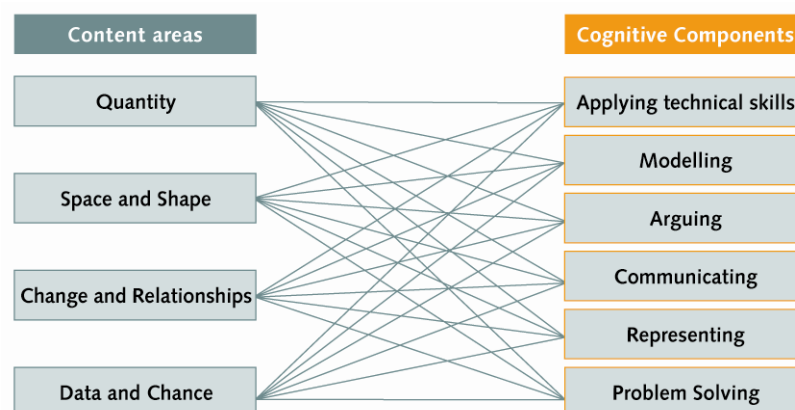


Fig. 1: Framework of mathematical competence in NEPS

The NEPS framework of mathematical competence distinguishes between content-related and process-related components (cf. Fig. 1). In detail, the content areas are characterized as follows:

- **Quantity** comprises all kinds of quantifications when numbers are used to organize and describe situations.
Examples from the *elementary sector*: comparisons of sets, counting (ordinal/cardinal aspects of numbers), simple operations (e.g., adding)
Examples from the *adult sector*: calculations of percentages and interests, calculations of area and volume, use of different units, simple equation systems
- **Space and Shape** includes all types of planar and spatial configurations, shapes or patterns.
Examples from the *elementary sector*: recognizing geometric shapes, simple properties of shapes, perspective
Examples from the *adult sector*: three-dimensional mathematical objects, geometric mappings, elementary geometric theorems
- **Change and Relationships** includes all kinds of (functional) relationships and patterns.
Examples from the *elementary sector*: recognizing and continuing patterns, relationships among numbers, proportionality
Examples from the *adult sector*: interpreting curves or function graphs, properties of linear, quadratic, and exponential functions, extremum problems
- **Data and Chance** comprises all situations involving statistical data or chance.
Examples from the *elementary sector*: intuitively assessing probabilities, collecting and structuring data
Examples from the *adult sector*: interpreting statistics, basic statistical methods, calculating probabilities

The cognitive components of mathematical thinking processes are distinguished as follows:

- **Applying technical skills** includes using known algorithms and remembering mathematical knowledge or calculation methods.
- **Modelling** includes the representation in a situation model and in a mathematical model as well as interpreting and validating results in real-life situations.
- **Arguing** includes assessing explanations and proofs, but also developing own explanations or proofs.
- **Communicating** requires communication on mathematical contents and includes, among other things, the correct and adequate use of mathematical technical terms.
- **Representing** comprises the use and interpretation of mathematical representations such as tables, charts or graphs.
- **Problem Solving** takes place, when there is no obvious approach, and, therefore, includes systematic trying, generalizing or examining special cases.

This differentiation renders the framework concept of mathematical competence in NEPS compatible with both the PISA studies and the German National Mathematics Education Standards. The test items used in NEPS refer to one content area that is mainly addressed by the item, but may well contain several cognitive components.

Bibliography

Organisation for Economic Co-Operation and Development [OECD] (2003). The PISA 2003 assessment framework – mathematics, reading, science and problem solving knowledge and skills. Paris: OECD.

Orthography

As empirical results at the end of elementary school reveal, fourth graders in part still show serious orthography problems (cf. Löffler & Meyer-Schepers, 2005). These problems verifiably extend across the entire secondary school period and increase even more (Schneider, 2008: 149). However, orthographic performance is seen as a reliable predictor for Students' educational path (Schneider, 2008). For these reasons, orthographic competence is tested as a stage-specific complement at secondary level in grade 5, 7 and 9.

In order to test orthographic competence in NEPS, a language-systematic test (SRT) was developed. It is based on a differential competence model (Blatt et al., 2011) empirically proved in the PIRLS-2006 complementary studies „Orthography“ (International Elementary School Reading Survey). This competence model is based on research in the linguistic field of graphemics (Eisenberg, 2006). According to the principles of German orthography shown by Eisenberg, five sub skills are differentiated (Tab. 1):

Tab. 1: Differential orthographic competence model according to the Eisenberg principles (2006)

Orientation Towards Principles	Subskills
Phonographic and syllabic principle in the core area	Understanding the corresponding syllabic structure of written and spoken words
Morphological principle in the core area	Understanding the structure of words in inflected and derived forms (morphological stability); Understanding inflectional morphemes
Peripheral area	Identifying exceptions in spelling; knowing the correct spelling of foreign words
Principles of word formation	Knowing parts of speech and derivational morphemes (i.e., for compounding)
Syntactic principle	Knowing about the capitalization of nouns and using syntactic structures for capitalization and punctuation

The tests are evaluated both on a whole-word level and in terms of the included subskills, and are broken down into structural units according to the subskills. Table 2 shows the segmentation of the noun <Eisenbahnausstellung> (railway exhibition):

Tab. 2: Classification of structural units

Subskills	Phonographic syllabic subskill	Morphological subskill	Peripheral subskill	Word formation subskill	Syntactic subskill

example for structural units	#eisen	#stell	#bahn	#aus #ung #eisenbahnausstellung (compounding)	#E
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The two-syllable structural unit #eisen has an open syllable and it has to be classified according to the phonographic syllabic subskill in the core area. The spelling of the double consonant in #stell is due to the morphological principle in the core area: #stell because of <stellen>. #bahn belongs because of the irregular marking of the long vowel to the peripheral subskill. Structural units in the word formation subskill are the prefix #aus, the suffix #ung and the compounding of the whole word. The majuscule #E is part of the syntactic subskill.

The test material is conform to the curriculum and provides an adequate number of structural units for testing all five subskills (Tab. 3).

Tab. 3: Number of structural units in grade seven

	Phonographic syllabic subskill	Morphological subskill	Peripheral subskill	Word formation subskill	Syntactic subskill
grade seven	62	79	45	110	92

In grade seven the test combines a cloze test with seven sentences and nine full sentences. This ensures that capitalization and punctuation can be measured reliably. In addition, this format is timesaving. The grade seven test includes 18 words in the cloze test and 119 words in the full sentences.

Bibliography

- Blatt, I., Voss, A., Kowalski, K. & Jarsinski, S. (2011): Messung von Rechtschreibleistung und empirische Kompetenzmodellierung. In Bredel, U. (Hrsg.), Weiterführender Orthographieunterricht. DTP 5. Baltmannweiler: Schneider Verlag Hohengehren, 226 - 256.
- Eisenberg, P. (2006): Grundriss der deutschen Grammatik. Band 1: Das Wort (3. Auflage). Stuttgart und Weimar: Metzler.
- Löffler, I. & Meyer-Schepers, U. (2005): Orthographische Kompetenzen: Ergebnisse qualitativer Fehleranalysen, insbesondere bei schwachen Rechtschreibern. In W. Bos, E.-M. Lankes, M. Prenzel, K. Schwippert, R. Valtin & G. Walther (Hrsg.), IGLU. Vertiefende Analysen zu Leseverständnis, Rahmenbedingungen und Zusatzstudien. Münster: Waxmann, 81 - 108.
- Schneider, W. (2008): Entwicklung und Erfassung der Rechtschreibkompetenz im Jugend- und Erwachsenenalter. In W. Schneider, H. Marx & M. Hasselhorn (Hrsg.), Diagnostik von Rechtschreibleistungen und -kompetenz. Göttingen: Hogrefe, 145 - 157.

Listening Comprehension in the First Languages (L1¹) Russian and Turkish

The effects of immigrant students' first language proficiency on their educational success are still highly disputed. On the one hand, theoretical perspectives and empirical evidence suggest positive effects of L1 proficiency on second language acquisition and on educational success within the country of residence (e.g., Cummins, 1979). On the other hand, neutral and negative effects of L1 proficiency are proposed (e.g., Esser, 2006). The empirical evidence of this controversy is, however, unsatisfactory because there is a lack of investigations systematically assessing L1 proficiency with objective tests (cf. Kristen et al., 2010).

In order to elucidate this controversy within the NEPS, the L1 proficiency of students from the two largest immigrant groups in Germany—that is students whose families immigrated from the area of the Former Soviet Union or from Turkey—is measured with objective tests. The NEPS assesses L1 proficiency at three measure points that are particularly relevant for educational trajectories: at secondary school level in Grade 9 and Grade 7 as well as at elementary school level in Grade 2. The proficiency in Russian and Turkish at these three measure points is assessed with listening comprehension tests specifically developed for this purpose (for Grade 9: Edele, Schotte, Hecht, & Stanat, 2012; Edele, Schotte, & Stanat, 2015; for Grade 7: Taraszow, Schotte, Edele, & Stanat, in preparation). The assessment of listening comprehension was chosen as a dimension of language proficiency because children of immigrants typically acquire the L1 within their family context and do not necessarily read or write their L1.

The L1-tests at secondary school level consist of several independent text units with a length of 100 to 150 words each. Every text unit is followed by four to five questions in a multiple-choice format, which the students were requested to answer. Both, text units and subsequent questions were audio recorded by native speakers of Russian or Turkish and presented to the students in a standardized way from CD. The construction of the L1-tests was based on the aim to assess a broad range of language proficiency. Therefore, texts representing written literary language (expositions and narrations) as well as texts involving oral features (dialogues) were used. In order to ensure that the L1-tests measure language proficiency rather than prior knowledge, the texts either cover topics that should be equally familiar to all students (e.g., everyday situations in school) or topics that are likely to be equally unfamiliar to all students (e.g., an explanation of the living conditions of a rare mammal). All text units were tested and validated by extensive pilot studies.

In order to allow for comparisons of students' first language proficiency between the Grades at secondary school level, two text units are part of both the L1-tests of Grade 7 and the L1-

¹ The term first language (L1) is used interchangeably with the language of the family's country of origin, irrespective of whether the student acquired this language prior to German, as the labeling L1 suggests, or simultaneously.

tests of Grade 9 (Taraszow, Schotte, Edele, & Stanat, in preparation). When using these 'anchor items', the objectively assessed L1 proficiency becomes comparable at different measure points of secondary school level.

Bibliography

- Cummins, J. (1979). Linguistic interdependence and the educational development of bilingual children. *Review of Educational Research*, 49(2), 222-251.
- Edele, A., Schotte, K., & Stanat, P. (2015). Listening Comprehension Tests of Immigrant Students' First Languages (L1) Russian and Turkish in Grade 9: Extended Report of Test Construction and Validation (NEPS Working Paper No. 57). Bamberg: Leibniz Institute for Educational Trajectories, National Educational Panel Study.
- Esser, H. (2006). *Sprache und Integration: Die sozialen Bedingungen und Folgen des Spracherwerbs von Migranten* [Language and Integration: Social determinants and consequences of language acquisition of immigrants]. Frankfurt am Main: Campus Verlag.
- Kristen, C., Edele, A., Kalter, F., Kogan, I., Schulz, B., Stanat, P., & Will, G. (2011). The education of migrants and their children across the life course. *Zeitschrift für Erziehungswissenschaft*, 14(2), 121-137. doi: 10.1007/s11618-011-0194-3

Metacognition

Metacognition is the knowledge and control of the own cognitive system. According to Flavell (1979) und Brown (1987), declarative and procedural aspects of metacognition are differentiated which are both covered in the National Education Panel.

Procedural metacognition

Procedural metacognition includes the regulation of the learning process through activities of planning, monitoring and controlling. Within the framework of NEPS in combination with the competence tests of the individual domains, the procedural aspect of metacognition is not assessed as a direct measure of such planning, monitoring and controlling activities but as a metacognitive judgement that refers to the control of the learning performance during (and/or shortly after) the learning phase (also see Nelson & Narens, 1990). After the study participants have taken their competence tests, they are requested to rate their own performance. They are asked to state the portion of questions presumably answered correctly.

Usually, one question is asked per domain. For competence domains that can be divided into coherent individual parts (e.g. reading competence referring to different texts), the inquiry of procedural metacognition is referred to these parts as well, which, of course, leads to a longer processing time.

Bibliography

- Brown, A. L. (1987). Metacognition, executive control, self-regulation, and other more mysterious mechanisms. In F. E. Weinert and R. H. Kluwe (Eds.), *Metacognition*,

motivation, and understanding (pp. 65-116). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Flavell, J. H. (1979). Metacognition and Cognitive Monitoring: A New Area of Cognitive-Developmental Inquiry. *American Psychologist*, 34, 906-911.

Nelson, T.O. & Narens, L. (1990). Metamemory: A theoretical framework and new findings. In G.H. Bower (Hrsg.), *The psychology of learning and motivation* (pp. 125-141). New York: Academic Press.