NEPS

National Educational Panel Study

Assessment of Procedural Metacognition Starting Cohorts 2-6 (Version: January 2015)

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Procedural Metacognition

A major goal of the National Educational Panel Study (NEPS) is the assessment of competencies that are considered to be of particular importance for educational pathways and participation in society. Longitudinal measurements of reading competence, listening comprehension, mathematical competence, and scientific literacy have been and will be carried out coherently across the life span. These measurements are supplemented with regular assessments of metacompetencies such as abilities to handle information technologies (ICT literacy) and metacognition (cf. Weinert et al., 2011).

Metacognition is conceptualized as cognition about cognition (Flavell, 1979) and encompasses two components. On the one hand, the declarative knowledge component refers to the knowledge about memory, comprehension, and learning processes that an individual can verbalize. The procedural component, on the other hand, focuses on how the learning process is controlled and regulated through planning, monitoring, and metastrategic activities. The NEPS aims at assessing both, that is, declarative and procedural aspects of metacognition over the life span. In the following, we focus on the assessment of procedural metacognition.

1. The Assessment of Procedural Metacognition

Within the framework of NEPS, the procedural aspect of metacognition is not assessed as a direct measure of such planning, monitoring, and controlling activities. Instead, metacognitive judgments of performance are used, and the assessment of procedural metacognition is integrated in various competence domains (cf. Weinert et al., 2011): Single indicators of judgments of performance are implemented directly after the test phase (retrospective judgment/post-diction, cf. Nelson & Narens, 1990; Schraw, 2009, cf. also Maki, Schields, Wheeler, & Zacchilli, 2005). For each competence domain, participants are asked to estimate their own achievement. Specifically, after completing all items in the respective test, participants are asked to give judgment about the number of correctly given answers. 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 refers to these parts as well.

The assessment of metacognitive judgments is integrated into the following domains:

- Reading competence (global judgment and judgments referring to single texts)
- Mathematical competence
- Listening comprehension at word level (receptive vocabulary), at sentence level (receptive grammar) and at discourse level
- Scientific literacy
- Abilities in handling information technologies (ICT literacy)
- Orthography (2 judgments)
- Competence in language of origin (Russian and Turkish)
- English language competence (foreign language)

Metacognitive judgments are not assessed for speed measures, such as reading speed, or specific tests assessing domain-general cognitive functioning.

After completing the competence tests in the above-listed domains, the participants are asked to estimate their own performance. An example of the domain reading competence is given in Figure 1.

Altogether, we asked you 33 questions about texts.

How many of these questions did you presumably answer correctly?

Please insert a number between 0 and 33 in the box.

Figure 1. Example of the assessment of a global metacognitive judgment in the domain reading.

The procedure is slightly adapted for Kindergarten and Grade school children: After completing the corresponding tests, children are shown a 5-point smiley scale (see Figure 2) and the survey supervisor asks the children: "What do you think: How many tasks did you do correctly?" The supervisor points to each of the smileys and explains what the individual smiley faces mean (e.g., sad-looking smiley face on the left hand side: no tasks correct, happy smiley face on the right hand side: all tasks correct). Then, Kindergarten children indicate their answer by pointing at the corresponding smiley face and the supervisor notes down the children's answers. Children in Grade school mark the smiley face in their test booklets. The children's answers are coded from 1 (no tasks correct) to 5 (all tasks correct).
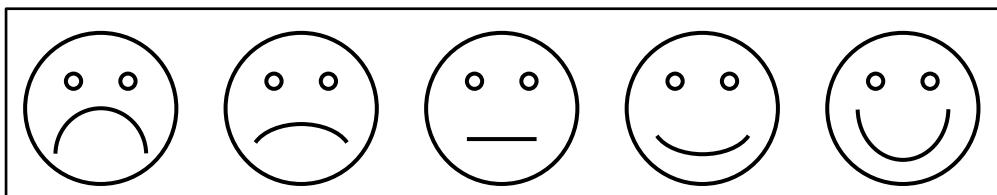

Figure 2. 5-point smiley scale used in Kindergarten and Grade School children.

2. Calculation of the Scores on Procedural Metacognition

Two measures pertaining to the metacognitive judgments are reported in the Scientific Use File: a) The estimated proportion of items solved correctly and b) a deviation score between the subjects' judgments and the actual performance.

a) To calculate the **estimated proportion of items solved correctly** the estimated number of items solved correctly is divided by the number of all items in the test:

That is, the estimated proportion of items solved correctly = $\dfrac{N\ estimated}{N\ items}$

With regard to the data of children in Kindergarten and Grade School, the values from 1 to 5 are transformed into proportions of items solved correctly (1 ⇨ 0; 2 ⇨ 0.25; 3 ⇨ 0.50; 4 ⇨ 0.75; 5 ⇨ 1).

b) As a measure of the accuracy of metacognitive judgments, **deviation scores** between the subjects' judgments and the actual performance in the respective tests are reported in the Scientific Use File (see Schraw, 2009).

The deviation score (d) is calculated as shown below:

$$d = \frac{N\ estimated}{N\ items} - \frac{N\ correct}{N\ items}$$

This means:

d = 0: perfect estimation of one's own performance

0 < d ≤ 1: overestimation of one's own performance

-1 ≤ d < 0: underestimation of one's own performance

For example, a person estimates that he or she presumably answered 24 out of 30 questions correctly. But in fact, the sum of questions answered correctly is only 15. Thus, the person overestimates his or her own performance and the resulting deviation score = 0.30.

$$d = \frac{24}{30} - \frac{15}{30} = 0.80 - 0.50 = 0.30$$

All items in a competence test are used to calculate the sum of questions answered correctly. In case complex multiple-choice questions or matching items are included in a competence test, an item is only considered to be correctly solved when all subtasks have been solved correctly. Hence, the maximum sum of items answered correctly corresponds to the number of questions that the participants worked on in their tests.

Please note: Although the general aim for the child was to finish all items, not all tests in the Kindergarten Cohort were fully completed until the last item. Concerning the tests on listening comprehension at word level (receptive vocabulary) and at sentence level (receptive grammar) in wave 1, the testing session was ended when a nonresponse or false response to a specified number of items occurred. Moreover, some children did not fully complete the test on mathematical competence in wave 2. Concerning the assessment in Grade 1 (wave 3), some tests had to be discontinued due to time restrictions. When children did not reach the end of the test because the test was discontinued, the estimated proportion of items solved correctly as well as the actual proportion of items solved correctly refer only to those items that the participants actually worked on in their tests.

For example, the test on receptive grammar was discontinued after 40 out of 48 items and 30 out of the 40 processed items were correct. The child points at the smiley face on the right hand side and indicates that he or she got all items on receptive grammar correct. Hence, the estimated proportion of items solved correctly is 1, the actual proportion of items solved correctly is 0.75 and the deviation score is 1 – 0.75 = 0.25.

Depending on his or her research questions, the user is asked to decide for him-/herself whether it might be reasonable to exclude those participants who did not reach the end of the corresponding competence test.

3. Data in the Scientific Use File

In the Scientific Use File 2015 measures of procedural metacognition are available for the first, second and third waves of starting cohorts 2 and 3, for the first and second waves of starting cohort 4, for the third wave of starting cohort 5, and for the third and fifth waves of starting cohort 6. The description of the samples as well as information on the implementation can be found on the NEPS website.[1]

Table 1 gives an overview of the assessment of procedural metacognition in the different starting cohorts and domains which are reported in the Scientific Use File 2015. The blanks in the table are due to the fact that not all of the listed domains are integrated in each study (cf. Weinert et al., 2011).

The data sets usually include two variables "estimated proportion of items solved correctly" and the "deviation score" based on the global judgments per domain. For the domain reading competence, the data sets additionally include variables referring to single texts. For the domain orthography, the variables refer to two sets of items. Examples of the variable names in the Scientific Use File are given below.

Example 1

Global Metacognitive Judgment for the Domain Mathematical Competence in Grade 9 (Estimated Proportion of Items Solved Correctly)

mp	g9	ma	_sc6
Procedural metacognition	Grade 9	Math competence	Estimated proportion of items solved correctly

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[1] www.neps-data.de

Table 1: Procedural Metacognition in Different Starting Cohorts and Domains in the Scientific Use File 2015.

Starting Cohort	Wave	Grade	Domains								
			Reading Competence (re)	Math Competence (ma)	Receptive Vocabulary (vo)	Receptive Grammatical Competence (gr)	Scientific Literacy (sc)	ICT Literacy (ic)	Orthography (or)	Native Language Competence (nt or nr)[c]	English Foreign (ef)
2	1				X	X	X				
2	2			X							
2	3	1		X	X	X	X				
3	1	5	X[a]	X					X[b]		
3	2	6			X		X	X			
3	3	7	X[a]	X					X[b]	X[c]	
4	1	9		X	X		X	X			
4	2	9	X[a]							X[c]	
4	3	10									X
5	3		X[a]	X							
6	3		X[a]	X							
6	5		X[a]				X	X			

[a] Global judgment and judgments referring to single texts
[b] 2 judgments
[c] Turkish or Russian

Example 2

Metacognitive Judgment Referring to Text 1 in the Domain Reading Competence in Grade 5 (Deviation Score)

mp	g5	re	01	_sc5
Procedural metacognition	Grade 5	Reading competence	Text 1	Deviation score

Missing responses: There are different reasons why missing responses occur in the scores on procedural metacognition. First, there are nonvalid responses or omitted responses in the metacognitive judgments themselves. Nonvalid responses occur, for example, if participants write down decimals, a number range (e.g., "10-20"), or values greater than the maximum in the corresponding test. Only whole numbers in the specified range are labeled as valid responses. Second, there are missings because participants do not reach the end of the corresponding competence test (e.g., when participants do not read all single tests of the reading competence test). These missing responses are labeled as "not-reached missing responses".

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