NEPS
National Educational Panel Study

Research Data

Information on Competence Testing

NEPS Starting Cohort 1 — Newborns

Education From the Very Beginning

Wave 9: 8 years

LIfBi
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Information on testing		
Sample	Study B128, students in second grade (8 years), Starting Cohort 1, wave 9, year 2020. The survey started at the beginning of March 2020 as a CAPI interview with computer-based testing. Only a few cases (N = 34) could be realised due to the outbreak of the Corona pandemic. The survey was stopped 2 weeks after field launch and continued as CAPI-by-Phone[1] with online testing from June 2020. The interviewer conducted the biographical interview by phone from home and also accompanied the child's online test by phone.	
Test situation	Computer-assisted personal interview (CAPI) with integrated task processing on the computer (TBT[2])	Computer-assisted telephone interview (CAPI-by-Phone) with online task processing (CAWI-TBT[2])
Test sequence	A biographical interview is conducted with a legal guardian of the target child in his/her own household. During the break of the biographical interview, the target children complete computer-based tasks on a tablet. The target children work through the competence tests themselves. The interviewer is responsible for administering the test transitions and, partially for conducting the instruction, if the instruction is not video based. After testing, the biographical interview with the legal guardian continues.	At the end of the biographical telephone interview (part 1) with a legal guardian of the target child, technical requirements in the household for online task processing are clarified. If these are fulfilled, the target children processed the online tests in the household on a technical device (tablet, laptop or computer) on a separate date (part 2). During the online test, the interviewer accompanied the target child via a phone speaker. In order to be able to answer questions about the instruction and the tests accurately, the interviewer receives a status about which page the child is currently on. There are also shown standardised speaking texts on her laptop screen.
	Rotations	
	The testing took place in the following order: 1. Reading speed 2. Early reading competence + procedural metacognition 3. Mathematical competence + procedural metacognition	
Test duration (net processing time)	Approx. 29 minutes (45 minutes incl. instructions)	Approx. 29 minutes (45 minutes incl. instructions)
Administration time (incl. survey)	Approx. 90 minutes (45 minutes TBT-testing; 45 minutes CAPI biographical interview).	Approx. 60 minutes (approx. 45 minutes online testing, approx. 15 minutes preparation test situation by phone).

[1] CAPI-by-Phone = telephone interview by the CAPI interviewer
[2] TBT = technology-based testing

		The biographical interview was conducted at a separate appointment before the online testing of the child.

Information on constructs				
Constructs	Number of items	Allowed processing time	Survey mode	Next measurement (expected)
Reading speed	100	3 min	CAPI (TBT)/CAWI (TBT)	2022
Early reading competence	26	7 min	CAPI (TBT)/CAWI (TBT)	2022
Mathematical competence	20	approx. 17 min	CAPI (TBT)/CAWI (TBT)	2022
Domain-specific procedural metacognition regarding the early reading competence domain	1	1 min	CAPI (TBT)/CAWI (TBT)	2022
Domain-specific procedural metacognition regarding the mathematical competence domain	1	1 min	CAPI (TBT)/CAWI (TBT)	2022

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 speed

In addition to the reading competence test which focuses on reading comprehension, an indicator of reading speed is collected, which primarily assesses basal reading processes and/or their automation. The Salzburg Reading Screening for Grades 2-9 (Mayringer & Wimmer, 2014; with permission of the publisher Hogrefe[3]) was used in Starting Cohort 1. The instrument was administered for tablet or laptop in a NEPS specific computer implementation for individual testing. The child is given simple sentences that can usually be answered based on general world knowledge, i.e., do not require specific prior content knowledge (e.g., "Mice can fly"). After each sentence, it must be indicated whether the sentence is correct in content ("true") or not ("false"). In the online delivery, the input was done via touch (tablet) or two keys on the keyboard (laptop), depending on the device. In the original CAPI version, input was implemented via touch on the tablet PC. Instruction was provided via video. In total, the instrument contains 100 sentences. When taking the test, participants mainly differ from each other with regard to the number of sentences they are able to process within the given time limit. Because the material is not demanding in terms of content, falsely processed and judged sentences are not taken into account in the measure. The measure of the reading speed is determined by the number of sentences that are correctly judged during the three-minute processing limit[4].

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[3] https://www.testzentrale.de/shop/salzburger-lese-screening-fuer-die-schulstufen-2-9.html

[4] The test for the higher starting cohorts was redesigned for NEPS purposes (Zimmermann, Artelt, & Weinert, 2014; Zimmermann, Gehrer, Artelt & Weinert, 2012), but it is also based on the test construction principles of the two Salzburg reading screenings (e.g., Auer, Gruber, Mayringer & Wimmer, 2005). It has a duration of two minutes.

Early reading competence

The operationalization of reading competence in the National Educational Panel Study (NEPS) during the early school years (i.e., elementary school Grade 2) does not follow the overall NEPS framework regarding the measurement of reading competence (see Gehrer, Zimmermann, Artelt, & Weinert, 2013). Studies on the development of reading competence report that children first have to figure out how letters and written words map onto their phonological form and to master basic decoding processes before they can begin to read for meaning (Cain, 2010; Ebert & Weinert, 2013). At the end of elementary school, children exhibit a more complex reading comprehension, which exceeds basic reading ability (Klicpera & Gasteiger-Klicpera, 1993; McElvany, Kortenbruck, & Becker, 2008). As the reading tests based on the NEPS framework include longer texts and require more sophisticated text comprehension, they are applied only from school Grade 4.

In order to (a) conduct a reliable and valid measurement of reading comprehension in early elementary school and (b) enable a comparison of the construct with the following school years, a widespread standardized test (i.e., A Reading Comprehension Test for 1st-6th Graders [ELFE 1-6], Lenhard & Schneider, 2006)[5] was applied in the NEPS for children in Grade 2 in Starting Cohort 2 (SC2). The follow-up version ELFE II – A Reading Comprehension Test for First to Seventh Graders (Lenhard, Lenhard & Schneider, 2017)[6] was administered in Starting Cohort 1 (SC1).

The main objective of the test is to measure early reading comprehension and not orthographic knowledge or articulation ability. The early reading comprehension is measured by ELFE 1-6[7] and ELFE II[8] using the following levels or subscales:

- Word comprehension (decoding and synthesizing)
- Reading speed (threshold of visual word recognition)
- Sentence comprehension (extracting meaning through reading and syntactic ability)
- Text comprehension from short stories (finding information, sentence comprehensive reading, deductive thinking)

The subscale text comprehension was employed in NEPS in the second grade of Starting Cohort 1 in the computer based version. The instruction was provided via video. The children were asked 26 questions about 17 short texts (2-7 sentences; maximum 74 words). Therefore, 1-3 questions were asked about each text. Students had to choose one out of four options by tapping (on the tablet) or clicking (with the mouse). Analogous to the original test, the completion time was 7 minutes for this subscale. In SC1 – in contrast to SC2 – the ELFE II test will again be administered in grade 4.

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[6] https://www.testzentrale.de/shop/ein-leseverstaendnistest-fuer-erst-bis-siebtklaessler.html
[7] https://www.psychometrica.de/elfe1-6.html
[8] https://www.psychometrica.de/elfe2.html

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Mathematical competence in kindergarten and early elementary/ primary education

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.

The NEPS framework of mathematical competence distinguishes between content-related and process-related components (cf. Fig. 1). According German National Mathematics Education Standards for primary education, five content-related components are distinguished which are adapted for NEPS as follows (KMK, 2004).

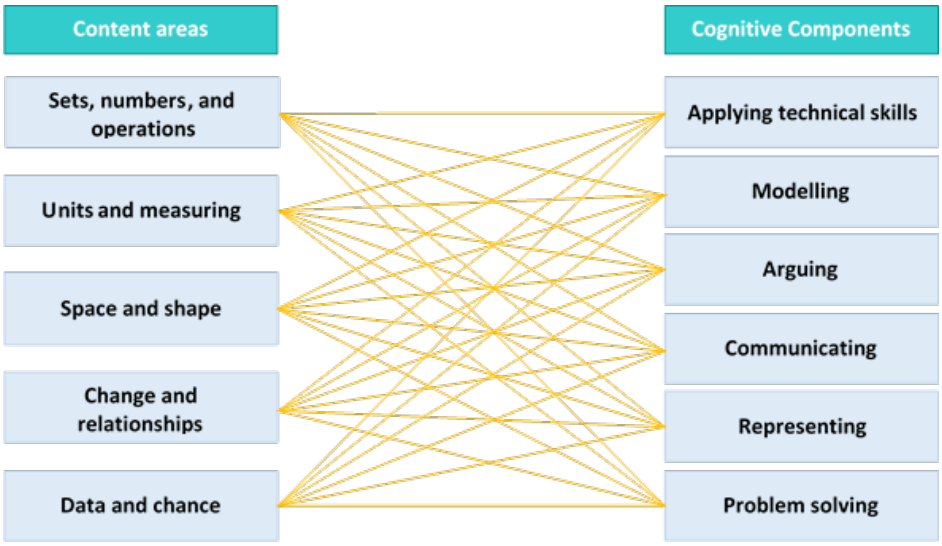

Fig. 1: Framework of mathematical competence in NEPS for elementary and primary education

- Sets, Numbers, and operations includes understanding numbers and their relations as well as contextualized calculations.
  Examples from the elementary and primary sector: comparisons of sets, counting (ordinal/cardinal aspects of numbers), simple operations (e.g., adding)
- Units and measuring comprises all kinds of quantifications when numbers are used to organize and describe situations.
  Examples from the elementary and primary sector: comparisons of sets, knowing and using units, simple fractions in connection with units, length comparisons
- Space and Shape includes all types of planar and spatial configurations, shapes or patterns.
  Examples from the elementary and primary sector: recognizing geometric shapes, simple properties of shapes, perspective
- Change and Relationships includes all kinds of (functional) relationships and patterns.
  Examples from the elementary and primary sector: recognizing and continuing patterns, relationships among numbers, proportionality

For the secondary and adult sector, the content-related components “Sets, numbers, and operations” and “Units and measuring” are considered under the term “Quantity”.
The cognitive components of mathematical thinking processes are distinguished as follows:

- Data and Chance comprises all situations involving statistical data or chance.
  Examples from the elementary sector: intuitively assessing probabilities, collecting and structuring data
  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.

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 (further description of the framework in Neumann et al., 2013). This differentiation renders the framework concept of mathematical competence in NEPS compatible with both the PISA studies and the German National Mathematics Education Standards. Some literature also show a high correlation between NEPS, the PISA studies and federal states comparisons from the Institute of Educational Quality Improvement (IQB): r = .89 for NEPS-PISA and r = .91 for NEPS-IQB (van den Ham, 2016).

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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. Kindergarten and elementary school children are shown a 5-point smiley scale to give their judgments.

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.

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