

### PIAAC-Panel (PIAAC-L) 2014: Cognitive Pretest

Lenzner, Timo; Neuert, Cornelia; Otto, Wanda; Landrock, Uta; Menold, Natalja

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## GESIS Project Reports

2014 | 14

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Cognitive Pretest

October - December 2014

*Timo Lenzner, Cornelia Neuert, Wanda Otto,  
Uta Landrock & Natalja Menold*



GESIS Project Reports 2014|14

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## **GESIS Project Reports**

GESIS – Leibniz-Institut für Sozialwissenschaften  
Survey Design and Methodology  
Postfach 12 21 55  
68072 Mannheim

Phone: +49 (0) 621 1246 - 227 / - 226 / - 228

Fax: +49 (0) 621 1246 - 100

E-Mail: [timo.lenzner@gesis.org](mailto:timo.lenzner@gesis.org) / [cornelia.neuert@gesis.org](mailto:cornelia.neuert@gesis.org) / [wanda.otto@gesis.org](mailto:wanda.otto@gesis.org)

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## 1 Aims of the pretest

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In the research project "PIAAC-Panel (PIAAC-L)" GESIS, LifBi and SOEP are jointly conducting one of the world's first internationally comparable long-term studies on competencies in adulthood and their significance in the life course. The Germany-wide long-term study PIAAC-L investigates questions such as "How do individual competencies affect the career paths of people in Germany?", "What is the connection between personal skills and professional mobility?", "How are competencies distributed within individual families/between partners?", and "What does this mean for career opportunities in our society?"

Within the framework of PIAAC-L, the German PIAAC sample will be surveyed and tested in three further surveys. In preparation for the survey, selected parts of the survey instrument should be subjected to a cognitive (laboratory) pretest under methodological and questionnaire-related aspects, revised based on the test results and - where possible - improved.

For this purpose, the GESIS pretest laboratory was commissioned by the PIAAC-L project group to carry out the cognitive pretest. Contact person on the part of the project group was Ms. Anouk Zabal from GESIS.



## 2 Sample

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<b>Number of cognitive interviews:</b>	20
<b>Selection of target population:</b>	Quota sampling
<b>Quota scheme:</b>	The test persons were selected according to age (18 - 40 years; 41years and older), school education (advanced technical college entrance qualification/ A-levels; no A-levels) and gender.

Age	School education	Women	Men	Sum
18 - 40	Less than A-levels	2	3	5
18 - 40	Advanced technical college entrance qualification/A-levels	3	2	5
41 +	Less than A-levels	3	2	5
41 +	Advanced technical college entrance qualification/A-levels	2	3	5
<b>TOTAL</b>		<b>10</b>	<b>10</b>	<b>20</b>

## Central characteristics of the 20 test persons:

Test person ID	Gender	Year of birth	School-leaving certificate*
01	female	1989	B
02	female	1982	C
03	female	1981	F
04	male	1980	B
05	male	1977	C
06	female	1990	G
07	female	1984	G
08	male	1991	G
09	male	1987	G
10	male	1980	C
11	female	1944	B
12	female	1957	B
13	female	1970	C
14	male	1948	B
15	male	1965	B
16	female	1973	G
17	female	1957	G
18	male	1955	G
19	male	1954	G
20	male	1959	G

- \* Codes:
- A - Leaving school without a lower secondary school-leaving certificate
  - B - Lower secondary school-leaving certificate
  - C - Secondary school-leaving certificate ("Mittlere Reife")
  - D - Polytechnic secondary school of the GDR with completion of the 8th or 9th class
  - E - Polytechnic secondary school of the GDR with completion of the 10th grade
  - F - Advanced technical college entrance qualification, completion of a technical secondary school
  - G - General or subject-related higher education entrance qualification / A-levels (High school or EOS, also EOS with apprenticeship)

### 3 Methods

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<b>Field time:</b>	27 October to 7 November 2014
<b>Number of cognitive interviewers (CI):</b>	5
<b>Pretests conducted in the lab (video-recorded):</b>	20
<b>Procedure:</b>	Use of an evaluation questionnaire
<b>Interview mode:</b>	CAPI
<b>Cognitive techniques:</b>	General Probing, Specific Probing, Comprehension Probing, Information Retrieval Probing, Confidence Rating, Emergent Probing.
<b>Incentive for respondents:</b>	30 Euro

## 4 Results

Question to be tested:

1. Im Folgenden geht es darum, dass Sie Ihre eigene Lesekompetenz einschätzen. Lesen ist die Fähigkeit, geschriebenen Text in Form von Sätzen und Abschnitten zu verstehen.

Ich lese Ihnen jetzt verschiedene Lesetätigkeiten vor. Bitte sagen Sie mir für jede dieser Tätigkeiten, wie gut Sie diese durchführen können. Denken Sie dabei an Ihre Erfahrungen aus Beruf und Alltag.  
Bitte geben Sie mir Ihre Antworten anhand dieser Liste.

[The following is about assessing your own reading skills. Reading is the ability to understand written text in the form of sentences and paragraphs.

I will now read to you various reading activities. For each of these activities, please tell me how well you can perform them. Think about your experiences from your job and everyday life.

Please give me your answers using this list.]

*(TL: Liste 1 vorlegen!)*

*[(Cl: Show list 1!)]*

Frequency distribution (N=20)

	Kann ich nicht [I cannot]	Kann ich, aber mit großen Schwierigkeiten [I can, but with great difficulty]	Kann ich, aber mit gewissen Schwierigkeiten [I can, but with certain difficulties]	Kann ich problemlos [I can without problems]
a. Einen kurzen Text, z.B. eine E-Mail oder eine kurze Mitteilung, querlesen und das Wesentliche erfassen. [Read a short text, e.g. an e-mail or a short message, cross-read and record what is important.]	-	-	1	19
b. Schriftliche Anweisungen, wie z.B. ein Rezept oder eine Arbeitsanweisung, lesen und korrekt befolgen. [Read and correctly follow written instructions, such as a recipe or work instructions.]	-	-	3	17
c. <b>Eine Bedienungsanleitung oder ein Handbuch lesen und verstehen, um ein neues Gerät bedienen zu können, z. B. einen Fernseher oder eine Waschmaschine.</b>	1	1	8	10

d.	Offizielle Dokumente lesen und verstehen, z.B. einen Arbeitsvertrag, einen Mietvertrag oder einen Versicherungsschein. [Read and understand official documents, such as an employment contract, a rental agreement or an insurance policy.]	-	3	10	7
e.	Verschiedene Internetseiten querlesen, um unterschiedliche Informationen zu einem bestimmten Thema herauszufinden, z.B. über eine Krankheit. [Cross-reading different internet pages to find different information on a specific topic, e.g. about a disease..]	-	-	7	12 <sup>1</sup>

#### Cognitive Techniques:

General Probing, Specific Probing, Comprehension Probing.

#### Findings:

In the first question, items c) and e) were tested systematically. There were no questions, comments or spontaneous remarks on the introductory text either by the test persons or by the cognitive interviewers, so that it can be assumed that the introduction is understood by the test persons.

Among the spontaneous comments of the test persons there are four comments that refer to the scale. Two test persons express problems with the values "without problems" and "with certain difficulties":

- *"What do you mean by "certain difficulties"? That it takes a little longer?"<sup>2</sup> (TP 09)*
- *"(...) if this includes reading not only once, but two or three times, then I can do it without problems."<sup>3</sup> (TP 16)*

Test person 02 also has problems with this and notes that one category is missing: *"I think a 5th would be missing here. I find "I can't" and "I can do without any problems", which is like either "Yes" or "No". And this (...) here "with great difficulty" or "with certain difficulties", I find that it is as if one could*

<sup>1</sup> Test person 11 does not use the Internet and therefore does not make any entries under item e), so that only 19 test persons answered this question.

<sup>2</sup> *„Was ist das denn jetzt mit „gewissen Schwierigkeiten“ gemeint? Dass es ein bisschen länger dauert?“ (TP 09)*

<sup>3</sup> *„(...) wenn dazu zählt, nicht nur einmal zu lesen, sondern zwei- oder dreimal, dann kann ich es problemlos.“ (TP 16)*

not do it properly. Now I would have a problem with saying "with certain difficulties", for example. Problem-free is crucial for a "Yes, I can". I don't know, I kind of miss..."<sup>4</sup> (TP 02)

A fourth test person states that the word "difficulties" is not appropriate and that effort would seem more appropriate for her at this point: "The word difficulties is not so clever here. With some effort would be better."<sup>5</sup> (TP 07)

The cognitive interview asked what the difference between the "with great difficulty" and "with certain difficulties" options was for the test subjects. Two test subjects have problems distinguishing (TP 02, 11):

- "[...] This with difficulties, that is for me then again such a term as if I could not do anything wrong."<sup>6</sup> (TP 02)
- "There's really no difference."<sup>7</sup> (TP 11)

With a third test person the distinction is also unclear: "Great difficulties would be for me if one must know one thing in order to understand the other. But it would also be very difficult if I had to read two or three times. Small or certain difficulties if I have to read it twice or parts of it several times."<sup>8</sup> (TP 05)

Of the 17 remaining test persons, ten test persons (TP 01, 03, 04, 06, 08, 13, 14, 15, 16, 20) associate "great difficulties" with the fact that the task or text is essentially not understood, i.e. that the (reading) activity cannot be carried out, for example:

- "Great difficulties are that I just cannot cope at all [...]"<sup>9</sup> (TP 06)
- "I have great difficulties when I cannot solve things, when they are unsolvable."<sup>10</sup> (TP 08)
- "When I have great difficulty, I understand nothing and do not see through."<sup>11</sup> (TP 14)

These test persons have problems to distinguish the category "I can, but with great difficulty" from the category "I cannot".

On the other hand, it is easy to distinguish between great and certain difficulties. Certain difficulties means that the 17 test persons who have no problems with differentiation have fewer difficulties: "Certain difficulties are less than great difficulties."<sup>12</sup> (TP 12).

<sup>4</sup> „Ich finde, hier würde noch ein 5. fehlen. Ich finde „kann ich nicht“ und „kann ich problemlos“, das ist so wie entweder „Ja“ oder „Nein“. Und das (...) hier „mit großen Schwierigkeiten“ oder „mit gewissen Schwierigkeiten“, ich finde, das ist so als ob man es nicht so richtig machen könnte. Ich hätte jetzt ein Problem damit zum Beispiel zu sagen „mit gewissen Schwierigkeiten“. Problemlos ist ausschlaggebend für ein „Ja, kann ich“. Ich weiß nicht, mir fehlt da irgendwie..." (TP 02)

<sup>5</sup> „Das Wort Schwierigkeiten ist hier nicht so geschickt. Mit gewisser Anstrengung wäre besser.“ (TP 07)

<sup>6</sup> „[...] Dieses mit Schwierigkeiten, das ist für mich dann wieder so ein Begriff, als könnte ich irgendwas nicht.“ (TP 02)

<sup>7</sup> „Da gibt's eigentlich keinen Unterschied.“ (TP 11)

<sup>8</sup> „Große Schwierigkeiten wären für mich, wenn man eine Sache kennen muss, um die andere verstehen zu können. Große Schwierigkeiten wären aber auch, wenn ich zwei- dreimal lesen muss. Kleine bzw. gewisse Schwierigkeiten, wenn ich es zweimal oder Teile davon mehrmals lesen muss.“ (TP 05)

<sup>9</sup> „Große Schwierigkeiten sind, dass ich halt gar nicht zurechtkomme [...]" (TP 06)

<sup>10</sup> „Große Schwierigkeiten habe ich, wenn ich Dinge nicht lösen kann, also sie unlösbar sind.“ (TP 08)

<sup>11</sup> „Wenn ich große Schwierigkeiten habe, dann verstehe ich nichts und blicke nicht durch.“ (TP 14)

<sup>12</sup> „Gewisse Schwierigkeiten sind weniger als große Schwierigkeiten.“ (TP 12)

Four test persons describe certain difficulties by saying that only parts of the (reading) activity cause difficulties (TP 04, 09, 16, 19), for example:

- *"Certain difficulties are partial."*<sup>13</sup> (TP 04)
- *"Certain difficulties means that there are small parts where I have to take a closer look."*<sup>14</sup> (TP 19)

For four test persons as well, certain difficulties mean that they have to reread text passages repeatedly (TP 01, 13, 18, 20):

- *"Certain difficulties are if I have to read it again."*<sup>15</sup> (TP 13)
- *"If I've read it two or three times, it'll come to me."*<sup>16</sup> (TP 18)

For another four test persons, the difference between great and certain difficulties is whether or not they have to ask someone or look something up (TP 07, 09, 10, 17):

- *"Big would mean if I would need help somewhere else again and have to ask someone else."*<sup>17</sup> (TP 07)
- *"So with certain difficulties I have to ponder briefly and with big ones I ask a friend or look on the Internet."*<sup>18</sup> (TP 10)

Furthermore, there are certain difficulties if the solution of the task takes more time (TP 06, 09).

Overall, it can be observed that the test persons associate with the answer category "I can, but with great difficulty" that they cannot do it - this indicates that this category is used incorrectly.

#### **Item c) Read and understand an instruction manual or manual to operate a new appliance, such as a television or washing machine.**

For this item the full width of the scale was used: Ten test persons, i.e. half of them, indicate "I can without problems", eight test persons say "I can, but with certain difficulties", one test person (TP 12) indicates "I can, but with great difficulties" and another one (TP 03) indicates "I cannot".

Overall, the test persons have no problems with the description "to operate a device". Out of 20 test persons, 16 think of technical devices, of which 13 test persons mention concrete devices such as TV, DVD recorder, laptop or telephone. Three persons name (additionally) furniture like cupboard (TP 08), desk (TP 13) or laminate (TP 14). With two test persons it remains unclear what kind of devices they think of (TP 05, 19).

Nine test persons think exclusively of longer texts (TP 01, 03, 06, 09, 12, 16, 17, 18, 19) and five test persons think exclusively of shorter texts (TP 05, 10, 11, 13, 14). Four test persons think of both shorter

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<sup>13</sup> „Gewisse Schwierigkeiten sind Teilbereiche.“ (TP 04)

<sup>14</sup> „Gewisse Schwierigkeiten heißt, dass es kleine Teile gibt, wo ich noch einmal genauer hinschauen muss.“ (TP 19)

<sup>15</sup> „Gewisse Schwierigkeiten sind, wenn ich es noch einmal lesen muss.“ (TP 13)

<sup>16</sup> „Wenn ich es zwei- dreimal gelesen habe, komme ich dann doch drauf.“ (TP 18)

<sup>17</sup> „Groß würde bedeuten, wenn ich nochmal irgendwo anders eine Hilfestellung bräuchte und jemand anderes fragen muss.“ (TP 07)

<sup>18</sup> „Also bei gewissen Schwierigkeiten muss ich kurz grübeln und bei großen frage ich einen Freund oder gucke im Internet.“ (TP 10)

and longer texts (TP 02, 04, 07, 08) and with another two test persons it remains unclear what they think of (TP 15, 20).

The test persons who stated that they are able to read and understand an instruction manual or a manual "with certain difficulties" justify this in three different ways. The first reason is that the operation or the construction of new things is complicated:

- *"But with other things, this is a very new area. And it's always a bit complicated for me."*<sup>19</sup> (TP 02)
- *"Assemble a desk. Such a DIN A4 sheet with a thousand screws and things."*<sup>20</sup> (TP 13)
- *"Sometimes the technical descriptions are too complicated and I am not that technically gifted and therefore sometimes there are difficulties when it is very extensive and complicated to understand the technology."*<sup>21</sup> (TP 18).

A second reason is that operating instructions must be read several times in order to understand them:

- *"If it was a technical manual, I would first read it and then try, but read it again to see if I did it right."*<sup>22</sup> (TP 07)
- *"If I have such an instruction manual with pictures and text, then I have to find my way in. Then I read it through two or three times."*<sup>23</sup> (TP 08)
- *"We have a big TV, it's new. Until I find out how it works, I read the instructions for use two or three times. (...) The instructions are not always 1A."*<sup>24</sup> (TP 17)

Test person 17, as well as two other test persons, justified their answer with poorly written operating instructions:

- *"This is a problem because these manuals are so bad. I could say I can do it without any problems if the manual is okay. If it's not okay, then I'm stuck. I recently bought laminate. There was a note in it that said, "This is ... It's so stupidly written."*<sup>25</sup> (TP 14)

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<sup>19</sup> „Aber bei anderen Sachen ist das ein sehr neues Gebiet. Und das ist für mich immer ein bisschen kompliziert.“ (TP 02)

<sup>20</sup> „Einen Schreibtisch zusammenbauen. So ein DIN-A4-Blatt mit Tausend Schrauben und Dingern.“ (TP 13)

<sup>21</sup> „Manchmal sind die technischen Beschreibungen zu kompliziert und ich bin nicht so technisch begabt und dadurch gibt's manchmal Schwierigkeiten, wenn es sehr umfangreich und kompliziert ist die Technik zu verstehen.“ (TP 18)

<sup>22</sup> „Bei einer technischen Anleitung würde ich es erst lesen und dann versuchen, aber nochmal nachlesen, ob ich es richtig gemacht habe.“ (TP 07)

<sup>23</sup> „Wenn ich so eine Bedienungsanleitung habe mit Bildern und Texten, dann muss ich mich erstmal reinfinden. Dann lese ich es auch zwei oder drei Mal durch.“ (TP 08)

<sup>24</sup> „Wir haben einen großen Fernseher, der ist neu. Bis ich dann herausfinde, wie es funktioniert, da lese ich zwei-, dreimal die Gebrauchsanweisung. (...) Die Anweisungen sind nicht immer 1A.“ (TP 17)

<sup>25</sup> „Das ist ein Problem, weil diese Bedienungsanleitungen so schlecht sind. Ich könnte sagen, ich kann es problemlos, wenn die Anleitung okay ist. Wenn sie nicht okay ist, dann hänge ich. Ich habe mir vor kurzem Laminat gekauft. Da war so ein Zettel drin, das ist ... puh. Der Zettel ist so blöd geschrieben.“ (TP 14)



- *"Then I thought of the operating instructions that were translated, for example, from Chinese into Swedish and then at some point into German."*<sup>26</sup> (TP 19)

Of the ten test persons who stated that they could read and understand operating instructions without problems, test person 06 and test person 20 also spontaneously commented on the problem of bad instructions:

- *"That depends on the instructions. Normally I can do that without any problems, but there are more complex instructions."*<sup>27</sup> (TP 06)
- *"That depends on the description. Normally I don't have any problems, but it really depends on the manual."*<sup>28</sup> (TP 20)

Five of the respondents with the answer "I can, without problems" justify this with intuition (TP 01), experience (TP 04), the short working steps (TP 05), that everything is described (TP 11) or that they understand it easily (TP 15).

Among the test persons who answered with no problems, there are three who report difficulties in the explanation of their answer:

- *"Most of the time these are very short steps, you can try them right away and then you're ready to go. With work instructions or packing lists it is already more difficult then. You first have to understand them so that you can implement them."*<sup>29</sup> (TP 05)
- *"I have now thought about this when I once wanted to reprogram my phone. It was so complex that it did not work the first time. I managed to do it then, therefore "without any problems", but it depends."*<sup>30</sup> (TP 06)
- *"If it is just about a television, then it is already in such a way that I read it again and again, so that I not only read it once, but also a second or third time, then perhaps again in sections and then try it out on the television. I am already in a position to make it work afterwards."*<sup>31</sup> (TP 16)

Conversely, test person 03 indicates certain difficulties, even if she understands simple operating instructions: *"(...) And a manual is always so much. How to put a new kettle into operation is obvious: put water in, plug in and then turn it on. It is all the same. You don't even need to read it anymore, but for other things it is a very new area. And for me it's always a bit complicated."* (TP 04)

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<sup>26</sup> *„Da habe ich an die Bedienungsanleitungen gedacht, die bspw. aus dem Chinesischen ins Schwedische und dann irgendwann ins Deutsche übersetzt wurden.“* (TP 19)

<sup>27</sup> *„Das kommt auf die Anleitung drauf an. Normalerweise kann ich das problemlos, aber es gibt auch komplexere Anleitungen.“* (TP 06)

<sup>28</sup> *„Das kommt auf die Beschreibung an. Normalerweise macht es mir keine Probleme, aber es kommt wirklich auf die Bedienungsanleitung an.“* (TP 20)

<sup>29</sup> *„Meistens sind das ganz kurze Schritte, die kann man gleich ausprobieren und dann geht's. Bei Arbeitsanweisungen oder Packlisten ist es dann schon schwieriger. Man muss sie erstmal verstehen, damit man sie umsetzen kann.“* (TP 05)

<sup>30</sup> *„Ich habe jetzt daran gedacht als ich einmal mein Telefon umprogrammieren wollte. Die war so komplex, dass das nicht gleich beim ersten Mal geklappt hat. Ich habe es dann hinbekommen, deswegen „problemlos“, aber es kommt darauf an.“* (TP 06)

<sup>31</sup> *„Wenn es gerade um einen Fernseher geht, dann geht es mir schon so, dass ich es auch immer mal wieder, also dass ich es nicht nur einmal lese, sondern gleich noch ein zweites oder drittes Mal, dann vielleicht nochmal abschnittsweise und dann am Fernsehgerät ausprobiere. Ich bin schon in der Lage, dass er danach auch funktioniert.“* (TP 16)

**Item e) Cross-reading different internet pages to find different information on a specific topic, e.g. about a disease.**

19 out of 20 respondents answered this item, test person 11 does not use the Internet and therefore does not answer item e). Twelve of the 19 respondents said that they could read different websites without problems, the remaining seven respondents could do so with certain difficulty.

All 19 test persons, who answered this item, think of different internet pages, i.e. of considering several text sources.

Of the 20 test persons, 16 understand the term "cross-reading" correctly. Twelve test persons understand the term "skimming over a text", two persons say that they do not read everything (TP 17, 20) and one person each states that they do not read in detail (TP 06) or search for keywords in the text (TP 07). The following are two examples of how the term "cross-reading" is described:

- *"So don't read through it completely, but fly over it. Don't read it properly, look through it quickly and get the most important things out."*<sup>32</sup> (TP 10)
- *"If I do not read every line, but skim the text like this."*<sup>33</sup> (TP 13)

Four test persons do not understand the term "cross reading" correctly: Two test persons do not know it (TP 03, 11) and two have a wrong understanding (TP 12: normal reading, TP 14: comparative reading of two texts).

The test persons 07 and 14 note that diseases are a bad example in their opinion: *"The topic of illness has irritated me here. This is by no means something I can only read across."*<sup>34</sup> (TP 07) and two other test persons express this at least indirectly:

- *"If these are any medical sites, I have no idea."*<sup>35</sup> (TP 01)
- *"With illness, it's the same thing. You read so much and in the end you know nothing."*<sup>36</sup> (TP 12)

#### Recommendations:

Question: Item c) Here it should be specified that longer texts are meant and not short How-Tos. The text of the question could be modified and simplified as follows: The term "devices" should be omitted and instead concrete examples should be given:

**"Read and understand detailed operating instructions or a manual in order to operate a new TV set or washing machine, for example."**

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<sup>32</sup> *„Also nicht komplett durchlesen, sondern mal drüber fliegen. Nicht richtig lesen, schnell durchgucken und das Wichtigste raus.“* (TP 10)

<sup>33</sup> *„Wenn ich nicht jede Zeile lese, sondern den Text so überfliege.“* (TP 13)

<sup>34</sup> *„Das Thema Krankheit hat mich hier irritiert. Das ist auf keinen Fall etwas, was ich nur querlesen kann.“* (TP 07)

<sup>35</sup> *„Wenn das irgendeine medizinischen Fachseiten sind, habe ich auch keine Ahnung.“* (TP 01)

<sup>36</sup> *„Mit Krankheit ist das auch so eine Sache. Da liest man so viel und zum Schluss weiß man dann doch nichts.“* (TP 12)

[„Eine ausführliche Bedienungsanleitung oder ein Handbuch lesen und verstehen, um bspw. einen neuen Fernseher oder eine neue Waschmaschine bedienen zu können.“]

Alternatively, only the word "detailed" can be added to the original item::

"Read and understand detailed operating instructions or a manual to be able to operate a new appliance, e.g. a television or washing machine."

[„Eine ausführliche Bedienungsanleitung oder ein Handbuch lesen und verstehen, um ein neues Gerät bedienen zu können, z. B. einen Fernseher oder eine Waschmaschine.“]

Item e): No changes recommended.

Answer categories: Obviously there are problems with the classification of the skills. On the one hand, there are discrepancies between the self-assessment of the test persons and the free assessment by the cognitive interviewers and, on the other hand, the test persons have difficulties in understanding the naming of scales. Therefore, the scale should be adjusted, especially since the question itself is about "how well can you do". Furthermore, the scale is not balanced or symmetrical. Our recommendation for the scale is therefore:

not good at all - less good - moderate - quite good - very good

[gar nicht gut - weniger gut - mäßig - ziemlich gut - sehr gut]

alternatively:

I can't - I rather can't - I can to some extent - I rather can - I certainly can

[kann ich gar nicht - kann ich eher nicht - kann ich einigermaßen - kann ich eher - kann ich sicher]

or alternatively:

"How easy or difficult is it for you...?" with the answer categories: very difficult - rather difficult - moderate - rather easy - very easy

[„Wie leicht oder schwer fällt Ihnen...?“ mit den Antwortkategorien: sehr schwer - eher schwer - mäßig - eher leicht - sehr leicht]

A legitimate answer from respondents may also be that they do not perform the respective activity in their everyday life or do not need to do so. Therefore, we recommend including an additional answer category, which, however, is not on the list and is not read out, but is only recorded by the interviewer if respondents express this on their own initiative:

„I never do that“

[„das mache ich nie“]

## Question to be tested:

2. Jetzt geht es darum, wie Sie Ihre Fähigkeit einschätzen, Zahlen zu verwenden und zu verstehen.

Ich lese Ihnen jetzt verschiedene alltagsmathematische Tätigkeiten vor. Bitte sagen Sie mir für jede dieser Tätigkeiten, wie gut Sie diese durchführen können. Denken Sie dabei an Ihre Erfahrungen aus Beruf und Alltag.

Bitte geben Sie mir Ihre Antworten wieder anhand dieser Liste.

[Now it's about how you assess your ability to use and understand numbers.

I will now read you various everyday mathematical activities. For each of these activities, please tell me how well you can perform them. Think about your experiences from your job and everyday life.

Please give me your answers again using this list.]

*(TL: Liste 1 liegt bereits vor!)*

*[(Cl: List 1 is already there!)]*

## Frequency distribution (N=20)

	Kann ich nicht [I cannot]	Kann ich, aber mit großen Schwierigkeiten [I can, but with great difficulties]	Kann ich, aber mit gewissen Schwierigkeiten [I can, but with certain difficulties]	Kann ich problemlos [I can without problems]
a. Prozente berechnen wie z.B. die Mehrwertsteuer ausrechnen. [Calculate percentages like e.g. calculating the value added tax.]	-	2	4	14
b. Einfache Flächen berechnen wie z.B. die Fläche einer Wand, um Fliesen zu kaufen. [Calculate simple areas such as the area of a wall to buy tiles.]	-	1	4	15
c. Einheiten umrechnen wie z.B. Milliliter in Liter oder Meilen in Kilometer. [Convert units such as milliliters to liters or miles to kilometers.]	-	3	5	12
d. Berechnungen durchführen, die mehrere Schritte oder Rechenoperationen erfordern, wie z.B. den günstigsten Handyvertrag für bestimmte Bedürfnisse ausrechnen. [Perform calculations that require several steps or arithmetic operations, such	-	3	2	14

	as calculating the cheapest cell phone contract for specific needs] <sup>37</sup>				
e.	Statistische Angaben oder Daten verstehen und interpretieren wie z.B. eine Abbildung mit der Entwicklung von Wohnungspreisen in verschiedenen Stadtteilen. [Understanding and interpreting statistical information or data, such as a graph showing the development of housing prices in different districts.]	3	1	3	13
f.	Informationen und Daten aus unterschiedlichen Quellen in Tabellen oder Grafiken übersichtlich zusammenfassen oder darstellen. [Summarize or display information and data from different sources in tables or graphics.]	3	3	6	8

#### Cognitive Techniques:

General Probing, Specific Probing, Comprehension Probing.

#### Findings:

There were no noteworthy comments on the introductory text as a whole from the test persons or the cognitive interviewers. All test persons were able to provide information on each individual item. However, the term "everyday mathematics" is generally uncommon and could be deleted in favor of a simplification of the question.

#### Item a) Calculate percentages like e.g. the value added tax.

14 test persons stated that they could calculate percentages without any problems, four test persons could do so with certain difficulties and two test persons stated that they could do so only with great difficulties.

Two test persons asked the cognitive interviewer whether the calculation should be done in the head or with the help of a pocket calculator, whereby test person 06 (answer: with great difficulty) assumes mental arithmetic when answering and test person 20 (answer: I can do it without any problems) decides to use a pocket calculator as an aid when classifying their everyday mathematical competence.

With the help of the questionnaire it becomes clear that 14 test persons (TP 01, 04, 06, 07, 08, 09, 10, 11, 13, 15, 16, 17, 18, 19) thought of mental arithmetic when assessing their abilities, two test persons (TP 03, 20) thought of using a calculator or cell phone and four thought of both (TP 02, 05, 12, 14).

When asked whether they would have answered differently if they had thought about using a calculator, five of the 14 test persons who thought about mental arithmetic said that they could do this without any problems.

<sup>37</sup> Test person 02 indicates that it [related to calculate most favorable phone contract] never does and assigns therefore no answer.

- *"If I had to do it, I would already know how to do the math. But when I'm standing in the store, I have a hard time doing it."*<sup>38</sup> (TP 06, answer: with great difficulty)
- *"If it is odd, it gets complicated, straight in the head. For example, if it's 27%, I need technical help."*<sup>39</sup> (TP 07, answer: with certain difficulties)
- *"At 50 %, 20 % or 10 % this is still possible, but as soon as 3 % of an odd number [should be calculated], it becomes more difficult. If I would calculate more often with a calculator and I would know how to do it in the calculator, it would be no problem. But I hardly ever do that."*<sup>40</sup> (TP 10, answer: with great difficulties)
- *"If you can write it down and calculate it with a calculator, then it works, but in your head like this."*<sup>41</sup> (TP 12, answer: with certain difficulties)

Consequently, the variance of the scale results from the different ways in which technical aids are considered or not considered. In other words, those who claim to have some or great difficulties with the calculation of percentages, e.g. VAT, do so because they assume that the data should be calculated in their head. Only test person 05, who thinks of both mental arithmetic and the use of a calculator, sticks to her assessment that this task causes her certain difficulties: *"I would have to think about it first and if I were to make a few mistakes, I would be fine. I would have to reach into certain areas of my brain that I otherwise never use. Nothing will change with a calculator, I think."*<sup>42</sup>

#### Item b) Calculate simple areas such as the area of a wall to buy tiles.

In terms of simple area calculation, e.g. the area of a wall to buy tiles, 15 test persons state that they can do this without any problems, four test persons are of the opinion that they can do this task with certain difficulties and one test person with great difficulties.

All test persons have a more or less comprehensive idea of what is meant by the term "simple surface". Apart from test person 12, who thinks of calculating the area of a circle, all test persons think of a rectangle when using this term or name the example wall. Furthermore, seven persons (TP 01, 04, 08, 10, 13, 15, 16) state that the term "simple surface" is used to connect a square and two test persons (TP 01, 04) triangles.

13 of the 15 test persons who state that they can easily calculate a simple area think of calculating a wall, i.e. a rectangle:

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<sup>38</sup> *„Wenn ich mich daran setzen soll, würde ich schon wissen wie man es rechnen muss. Aber wenn ich im Laden stehe, dann tue ich mich schwer damit.“* (TP 06)

<sup>39</sup> *„Wenn es ungerade ist, wird es kompliziert, gerade im Kopf. Bei bspw. 27 % da bräuchte ich technische Hilfe.“* (TP 07)

<sup>40</sup> *„Bei 50 %, 20 % oder 10 % geht das noch, aber sobald 3 % von einer ungeraden Zahl [berechnet werden sollen], wird es schon schwieriger. Wenn ich öfter mit Taschenrechner rechnen würde und ich im Taschenrechner wüsste wie das geht, dann problemlos. Aber das mache ich so gut wie nie.“* (TP 10)

<sup>41</sup> *„Wenn man es aufschreiben kann und mit dem Taschenrechner ausrechnen, dann geht das, aber so im Kopf.“* (TP 12)

<sup>42</sup> *„Ich müsste erst einmal überlegen und würde da bestimmt ein paar Fehler machen, dann ginge das schon. Ich müsste da in gewisse Bereiche in meinem Gehirn, die ich sonst nie benutze, vordringen. Da wird sich nichts ändern mit Taschenrechner, denke ich.“* (TP 05)

- "Length times width."<sup>43</sup> (TP 02)
- "I also laid laminate myself in my apartment. You take length times width, how many square meters you need."<sup>44</sup> (TP 09)
- "I can definitely calculate the area of a wall. Length times width. A two-dimensional surface."<sup>45</sup> (TP 16)
- "2.5 meters by 4 meters, that's relatively easy."<sup>46</sup> (TP 19)

Test persons 08 and 11, who also report no problems with the calculation, think of somewhat more complex area calculations:

- "Multiply in your head, estimate and measure. That is no problem to calculate an area. Most of the time you have the formulas in your head and then you can easily calculate the area."<sup>47</sup> (TP 08)
- "I have to know how many square meters. First in meters and then in square meters, then I have to add it up. Of course I can't calculate the number of plates, you have to tell the man where I buy [the plates]."<sup>48</sup> (TP 11)

Of the five test persons who would have certain (TP 05, 06, 12, 17) or great (TP 03) difficulties with this task, four think of more extensive calculations of areas:

- "There I add up the 4 walls, so 3.5 x 4 m for wallpaper, for example."<sup>49</sup> (TP 03)
- "Length times width would be easy, but as soon as a part has to be moved e.g. away from the heating, then I don't know how to subtract something from what."<sup>50</sup> (TP 05)
- "Calculate a barrel or a circle."<sup>51</sup> (TP 12)
- "I have the problem, I need the formula. There are people who can get it out of their heads, but I always need a formula."<sup>52</sup> (TP 17)

Test person 06, who also has certain difficulties, however, thinks of simple calculations.

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<sup>43</sup> „Länge mal Breite.“ (TP 02)

<sup>44</sup> „Ich habe auch selber Laminat verlegt in meiner Wohnung. [...] Da nimmt man Länge mal Breite, wie viel m<sup>2</sup> man braucht.“ (TP 09)

<sup>45</sup> „Ich kann auf jeden Fall die Fläche berechnen von einer Wand. Länge mal Breite. Eine zweidimensionale Fläche.“ (TP 16)

<sup>46</sup> „2,5 Meter mal 4 Meter, das ist relativ einfach.“ (TP 19)

<sup>47</sup> „Im Kopf multiplizieren, abschätzen und abmessen. Das ist kein Problem einen Flächeninhalt zu berechnen. Meistens hat man ja die Formeln im Kopf und dann kann man ganz leicht die Fläche berechnen.“ (TP 08)

<sup>48</sup> „Ich muss ja wissen wie viele Quadratmeter. Erst mal in Metern und dann in Quadratmetern, dann muss ich es zusammenrechnen. Ich kann natürlich nicht die Plattenzahl ausrechnen, das muss man dem Mann sagen, wo ich [die Platten] kaufe.“ (TP 11)

<sup>49</sup> „Da addiere ich die 4 Wände, also 3,5 x 4 m z. B. für Tapeten.“ (TP 03)

<sup>50</sup> „Länge mal Breite wäre leicht, aber sobald ein Teil z.B. von der Heizung weg soll, dann weiß ich nicht wie man was von was abziehen soll.“ (TP 05)

<sup>51</sup> „Ein Fass oder einen Kreis berechnen.“ (TP 05)

<sup>52</sup> „Ich habe das Problem, ich brauche die Formel. Es gibt Leute, die das aus dem Kopf können, aber ich brauche immer eine Formel.“ (TP 17)

Again, the variance of the scale is largely due to the presumed complexity of the computational operations to be performed and not exclusively to the assessment of the underlying computational competence.

#### Item c) Convert units such as milliliters to liters or miles to kilometers.

Twelve test persons state that they manage to convert units without any problems, five test persons find this task somewhat difficult and three test persons even find it very difficult.

None of the 20 test persons express any difficulties in understanding the term "mile". However, eight test persons (TP 03, 08, 09, 10, 13, 15, 16, 17) do not think of the conversion of miles into kilometers when answering, but of something else:

- *"I immediately think of cooking or baking with American recipes, where everything is given in "cups"."*<sup>53</sup> (TP 05)
- *"First of all I think of measures of length, cm in dm and m etc."*<sup>54</sup> (TP 10)
- *"If I measure something in the measuring cup, e.g. half a liter, then that is 50 cl and 500 ml. Or meters in kilometers."*<sup>55</sup> (TP 12)
- *"Convert one pound of coffee. I prefer grams."*<sup>56</sup> (TP 13)

Another ten test persons (TP 01, 05, 06, 07, 11, 12, 14, 18, 19, 20) can understand the term "mile", but they do not know the conversion factor:

- *All those simple units from milli to micro or no idea what, yes, but from miles to kilometers that's something else. I'd have to look up, what is a mile."*<sup>57</sup> (TP 01)
- *"Well, there are certain difficulties with miles and kilometers, because I would have to look it up first because I don't know. I'd have to know how long a mile is first."*<sup>58</sup> (TP 14)
- *"I don't know now how to express miles in kilometers."*<sup>59</sup> (TP 19)

This leaves two test persons (TP 02, 04) who know the conversion factor from miles to kilometers and take this into account in their answers. Test person 04 explicitly deals with the conversion of both mentioned examples: *"Milliliter in liter is a decimal shift and miles in kilo-meter is 1.6 and this has to be converted."*<sup>60</sup> (TP 04)

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<sup>53</sup> „Ich denke da sofort an kochen oder backen mit amerikanischen Rezepten, dort wird alles in „Cups“ angegeben.“ (TP 05)

<sup>54</sup> „Da denke ich zunächst an Längenmaße, cm in dm und m etc.“ (TP 10)

<sup>55</sup> „Wenn ich etwas im Messbecher abmesse, z.B. einen halben Liter, dann sind das 50 cl und 500 ml. Oder Meter in Kilometer.“ (TP 12)

<sup>56</sup> „Ein Pfund Kaffee umrechnen. Ich habe da lieber Grammangaben.“ (TP 13)

<sup>57</sup> „Die ganzen einfachen Einheiten von Milli zu Mikro oder keine Ahnung was, schon, aber von Meilen zu Kilometer das ist was anderes. Da müsste ich erst einmal gucken, was ist eine Meile.“ (TP 01)

<sup>58</sup> „Naja da gibt es gewisse Schwierigkeiten mit Meilen und Kilometer, weil ich das erst mal nachschlagen müsste, weil ich das nicht weiß. Ich muss erst mal wissen wie lang eine Meile ist.“ (TP 14)

<sup>59</sup> „Die genaue Angaben Meilen in Kilometer auszudrücken, weiß ich jetzt nicht.“ (TP 19)

<sup>60</sup> „Milliliter in Liter ist eine Kommaverschiebung und Meilen in Kilometer ist 1,6 und das muss man umrechnen.“ (TP 04)



Except for test persons 02 and 04 (conversion of miles to kilometers) and 05 (conversion of "cups" to grams), the majority of respondents only consider the conversion of units within the metric system when answering.

When asked how easy or difficult it was for them to answer this statement about the conversion of units, only four test persons (TP 06, 07, 08, 14) classified this as "rather difficult", mainly because they did not know the conversion factor from miles to kilometers.

**Item d) perform calculations that require several steps or arithmetic operations, such as calculating the cheapest cell phone contract for specific needs.**

Also in this everyday mathematical activity almost three quarters of the test persons (n=14) state that they can do this without any problems, two test persons can do this with certain difficulties and three with great difficulties. One test person does not make any statement because he says of himself that he never calculates cell phone contracts for certain needs.

There are two questions of particular interest in this item. One is to find out if the test persons think of several arithmetical operations when answering the question and the other is to find out if the mentioned example of calculating the most favourable cell phone contract for certain needs is useful for answering the question. When asked which arithmetical operations the test persons thought of, the answers vary from basic arithmetical operations such as addition and multiplication to equations or trisentence calculation up to the calculation of functions e.g. a straight line. With a total of 14 test persons (TP 01, 02, 03, 04, 05, 06, 07, 09, 12, 13, 14, 16, 18, 19) it becomes clear that they thought of several arithmetical operations when answering, regardless of whether they were referring to cell phone contracts or not:

- *"Calculate three-sentence calculation in the same way as for fuel consumption. I do that occasionally in my head and it's easy for me."*<sup>61</sup> (TP 04)
- *"I think that's something you do more often. The contract has this and the other has that. I might not use one of them. Or I have free SMS. [...] For a short time I thought of a formula where different things are used one after the other, but you can't calculate that directly with the contract. You have different steps."*<sup>62</sup> (TP 06)
- *"I do also always make that, if I must decide between two offers, that does not have to be always a cell phone contract, then one goes also there and computes only times. For example also electricity providers. That I compare the fixed costs and also the variable costs and look at me, what I need and/or use. That can also be a multi-level comparison calculation."*<sup>63</sup> (TP 09)

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<sup>61</sup> „Dreisatzrechnung so wie beim Spritverbrauch ausrechnen. Das mache ich gelegentlich im Kopf und es fällt mir schon leicht.“ (TP 04)

<sup>62</sup> „Ich finde das macht man halt öfter. Der Vertrag hat das und der andere das. Das eine benutze ich vielleicht nicht. Oder ich habe Frei-SMS. [...] Kurzzeitig habe ich an eine Formel gedacht, wo verschiedene Dinge nacheinander eingesetzt werden, aber beim Vertrag kann man das nicht direkt ausrechnen. Man hat verschiedene Schritte.“ (TP 06)

<sup>63</sup> „Das mache ich auch immer, wenn ich mich entscheiden muss zwischen zwei Angeboten, das muss ja nicht immer ein Handytarif sein, dann geht man auch hin und berechnet erst mal. Bspw. auch Stromanbieter. Dass ich die Fixkosten vergleiche und auch die variablen Kosten und mir anschau, was brauche bzw. verbrauche ich. Das kann auch eine mehrstufige Vergleichsrechnung sein.“ (TP 09)

- *"I was thinking about some text tasks where you have to do several steps. First like this, then plus, minus and then a three-part sentence in the back."*<sup>64</sup> (TP 16)

The remaining six test persons (TP 08, 10, 11, 15, 17, 20) refer to the example "cell phone contract", but in their explanations they only refer to comparing the costs of different flat rates:

- *"It is not a multiple bill. You compare who offers the cheapest Allnet flat rate and has a good net and all that. Well, I'll manage that, I'll have to find the right cell phone contract."*<sup>65</sup> (TP 10)
- *"To the calculation from the telephone provider for me. 25€ and 9,95€ are a big difference for me."*<sup>66</sup> (TP 11)
- *"I was thinking about the cell phone contract. Per month, with Internet flat rate without Internet flat rate, i.e. the services per month."*<sup>67</sup> (TP 17)
- *"You read it through. So and so much Flatrate for so much euro etc. and compare that."*<sup>68</sup> (TP 20)

There is no assessment of their everyday mathematical competence with regard to their ability to use a multi-stage calculation method. These six test persons all decide on the answer category "I can without problems". This means that six of the 14 persons who claim to be able to do this without any problems, may be misplaced due to an incorrect understanding. Furthermore, it means that the example of calculating the cheapest cell phone contract no longer works today, since the costs for the widespread smart phones are based on flat rates and there is no longer any need for a multi-stage calculation method with basic arithmetic operations. In addition, there are also comparison computers on the Internet that can perform the actual computing power when the user enters the individual usage data.

#### **Item e) Understanding and interpreting statistical information or data, such as a graph showing the development of housing prices in different districts..**

This is the first item to use the full scale width. While eight test persons state that they can easily understand and interpret statistics and data using the example of housing price developments in different parts of the city, six test persons believe they can do so with some difficulty and one person with great difficulty. Three test persons state that they are not able to do so.

There are indications that two test persons (TP 03, 11) do not understand the statement in the intended sense:

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<sup>64</sup> *„Ich habe da an irgendwelche Textaufgaben gedacht. bei denen man dann auch mehrere Schritte machen muss. Erst so, dann Plus, Minus und dann noch ein Dreisatz hintendran.“* (TP 16)

<sup>65</sup> *„Es ist ja keine Mehrfachrechnung. Da vergleicht man, wer die günstigste Allnet-Flat anbietet und ein gutes Netz hat und sowas. Also das kriege ich noch hin, den passenden Handyvertrag rauszusuchen.“* (TP 10)

<sup>66</sup> *„An die Berechnung vom Telefonanbieter für mich. 25€ und 9,95€ sind ein großer Unterschied für mich.“* (TP 11)

<sup>67</sup> *„Ich habe an den Handyvertrag gedacht. Pro Monat, mit Internet-Flatrate ohne Internet-Flatrate, also die Leistungen pro Monat.“* (TP 17)

<sup>68</sup> *„Man liest es durch. So und so viel Flatrate für so viel Euro usw. und vergleicht das.“* (TP 20)

- *"I know what it costs here, what it costs in Frankfurt, what it costs in Heidelberg. That is no problem. Frankfurt is expensive, Mannheim is cheaper, Heidelberg is in the middle."*<sup>69</sup> (TP 03, answer: I can without problems)
- *"I have a house and know how many square meters that is, but the other one no. In the newspaper, I can understand that. Often there are certain square meters for apartment rentals. I understand that, but how much it should cost and how expensive the real estate agent is, I have never dealt with that."*<sup>70</sup> (TP 11, answer: I cannot)

These two people think of costs that may be incurred for rental housing, but not of illustrations of price developments and their interpretation.

In contrast, the following test persons, for example, refer to concrete statistical information that may contain images. Here it becomes clear that persons have very different associations.

- *"We had this once in an Excel course with bar charts or something and I never knew what to get out of it, honestly."*<sup>71</sup> (TP 05)
- *"This is again so that it is not commonplace. When you look at something like this, you first have to come in and understand what the axes mean and that's what I find the certain difficulties."*<sup>72</sup> (TP 08)
- *"A coordinate system with an x and y axis and there you can see the development. I can also interpret it."*<sup>73</sup> (TP 09)
- TP 12: *"I haven't done that yet. Maybe I could, I can't tell you."*<sup>74</sup>  
 CI: *"What if it was about a diagram in the newspaper?"*<sup>75</sup>  
 TP 12: *"I probably could. But I was thinking about big plans and calculations etc."*<sup>76</sup>
- *"You'll have to get your head into it. Then there are circles. Then it says what costs what. But I don't deal with that in the same way."*<sup>77</sup> (TP 13)
- *"I thought of a cake like this [pie chart]. I can read that."*<sup>78</sup> (TP 16)

<sup>69</sup> „Ich weiß, was es hier kostet, was es in Frankfurt, was es in Heidelberg kostet. Das ist kein Problem. Frankfurt ist teuer, Mannheim ist günstiger, Heidelberg ist in der Mitte.“ (TP 03)

<sup>70</sup> „Ich habe ein Haus und weiß wie viele Quadratmeter das sind, aber das andere nein. In der Zeitung, die verstehe ich schon. Oft stehen da bestimmte Quadratmeter für Wohnungsvermietungen. Das verstehe ich schon, aber wie viel die kosten soll und wie teuer der Makler ist, damit habe ich mich nie befasst.“ (TP 11)

<sup>71</sup> „Wir hatten das mal in einem Excel-Kurs mit Balkendiagrammen oder so was und ich wusste nie was man davon hat, ehrlich gesagt.“ (TP 05)

<sup>72</sup> „Das ist wieder so, dass es nicht alltäglich ist. Wenn man sich sowas anschaut, muss man erst reinkommen und verstehen was die Achsen bedeuten und das sind für mich die gewissen Schwierigkeiten.“ (TP 08)

<sup>73</sup> „Ein Koordinatensystem mit einer x- und y-Achse und da sieht man auch die Entwicklung. Interpretieren kann ich das auch.“ (TP 09)

<sup>74</sup> „Ich habe das noch nicht gemacht. [...] Vielleicht könnte ich es doch, ich kann es Ihnen nicht sagen.“ (TP 12)

<sup>75</sup> „Und wenn es um ein Diagramm in der Zeitung ginge?“ (CI)

<sup>76</sup> „Das könnte ich wahrscheinlich. Aber ich habe da an große Pläne und Berechnungen etc. gedacht.“ (TP 12)

<sup>77</sup> „Da muss man sich dann reindenken. Da sind dann so Kreise. Da steht dann, was was kostet. Aber damit befasse ich mich nicht so.“ (TP 13)

For the evaluation of this item it is of particular relevance whether the test persons perceive the activity in the sense of "understand and interpret" according to the actual wording. The above quotations show that they correctly refer to the reception and not to the active creation - as in item f).

#### Item f) Summarize or display information and data from different sources in tables or graphics.

The full scale width is also used for this item. A total of eight test persons state that they can summarize or display information and data in tables and graphics, six persons can do so with certain difficulties, three with great difficulties and three test persons state that they cannot do so.

When asked, twelve test persons (TP 01, 05, 06, 07, 08, 09, 14, 15, 16, 17, 19, 20) stated that they had thought of creating tables or graphics themselves when answering:

- *"Because I had to work with illustrations and statistics for my final papers in my student days, or I had to create one myself. Then this goes along with the fact that I have to present information in illustrations."*<sup>79</sup> (TP 09)
- *"I always enjoy doing that. Take stock of who has come to me in practice and I also create graphics myself."*<sup>80</sup> (TP 17)

The other eight test persons (TP 02, 03, 04, 10, 11, 12, 13, 18), on the other hand, refer to understanding tables and graphics, i.e. merely receiving them and not actively creating them. *"If you are busy reading something like this every day. General graphics and statistics."*<sup>81</sup> (TP 13)

In general, it is noticeable that the test subjects rarely refer to concrete information or data that are to be summarized or presented, but rather mostly make generalized statements. A total of nine persons (TP 01, 02, 03, 10, 11, 12, 13, 14, 16) state that they have great or certain difficulties with it or are unable to do so because they are not concerned with it or are simply afraid of it:

- *"I would have to deal with everything first. Think about it for a moment, but then it should work out."*<sup>82</sup> (TP 01, answer: certain difficulties)
- *"I am missing an example here. I cannot answer, because there is no example to take away my fear. Then the question wouldn't be so bad either."*<sup>83</sup> (TP 10, Answer: great difficulties)
- *"Too many tables and graphics. So I assumed directly that I couldn't do it."*<sup>84</sup> (TP 12, Answer: I cannot)

<sup>78</sup> „Da habe ich an so einen Kuchen [Tortendiagramm] gedacht. Sowas kann ich lesen.“ (TP 16)

<sup>79</sup> „Weil ich für meine Abschlussarbeiten in meiner Studienzeit auch mit Abbildungen und Statistiken arbeiten musste, oder auch selber eine erstellen musste. Dann geht das mit einher, dass ich Informationen in Abbildungen darstellen muss.“ (TP 09)

<sup>80</sup> „Ich mache das immer ganz gerne. Ziehe Bilanz, wer zu mir in die Praxis gekommen ist und da lege ich auch selber Grafiken an.“ (TP 17)

<sup>81</sup> „Wenn man sich tagtäglich damit beschäftigt so etwas zu lesen. Allgemein Grafiken und Statistiken.“ (TP 13)

<sup>82</sup> „Ich müsste mich erst einmal mit allem auseinander setzen. Kurz überlegen, dann dürfte das aber auch klappen.“ (TP 01)

<sup>83</sup> „Mir fehlt hier ein Beispiel. Ich kann nicht antworten, weil kein Beispiel da ist, welches mir die Angst wegnimmt. Dann wäre die Frage auch nicht so schlimm.“ (TP 10)

<sup>84</sup> „Zu viel Tabellen und Grafiken. Da bin ich direkt davon ausgegangen, dass ich es nicht kann.“ (TP 12)

- *"That sounds so complicated and that's something I don't really like to do. It sounds complicated and you really have to think about what is meant by that."*<sup>85</sup> (TP 16, answer: certain difficulties)

Those test persons (N=8) who state that they can easily master this everyday mathematical activity think of graphics, illustrations or the presentation of statistics in tables:

- *"For example, surveys in the university, you also have to present them in tabular form."*<sup>86</sup> (TP 08)
- *"For example, I was thinking about complex Excel spreadsheets."*<sup>87</sup> (TP 19)

While in items a)-e) an example is given of what is meant by the everyday thematic activity described above, no specification is given here. Apart from test person 10, there is no indication that this omission leads to problems in answering. On the other hand, it is not always understandable why twelve test persons choose answers ranging from "I cannot" to "I can but with certain difficulties". This kind of answering behavior can be based on the fact that they do not deal with the subject matter in everyday life or have little practice, perhaps they do not even need it in everyday life or it is unclear to them what the item is aimed at.

The use of the term "or" in the phrase "tables or graphs" is not perceived as problematic here, rather it appears as a non-exclusive disjunction, i.e. an inclusive "or". This enables the test persons to refer to one of the two aspects or both together. No test person indicates to answer differently for the creation of tables than for graphics.

#### Recommendations:

- Question:
- Item a) The variance in response behavior is largely due to the use of technical aids. Therefore, it should be specified whether only mental arithmetic or also the use of tools such as paper or calculators is allowed.
- Item b): No changes recommended.
- Item c) Only two test persons consider both examples when answering. If the conversion between metric and American systems is of central importance, this should be recorded explicitly and above all individually:
- "Convert units of different measurement systems, e.g. miles to kilometers."**
- [„Einheiten unterschiedlicher Messsysteme umrechnen, z. B. Meilen in Kilometer.“]
- If this is not desired or irrelevant in terms of the construct, only examples within a system should be used:
- "Convert units such as milliliters into liters or meters into kilometers"**
- [„Einheiten umrechnen wie z.B. Milliliter in Liter oder Meter in Kilometer.“]
- Item d) It is not clear, what is meant by the abstract notion "arithmetic operations". To make clear, what shall be considered at this item, either the formula-

<sup>85</sup> „Das klingt schon so kompliziert und das ist sowas, was ich nicht so wirklich gerne mache. Das klingt kompliziert und da muss man wirklich nachdenken, was damit gemeint ist.“ (TP 16)

<sup>86</sup> „Zum Beispiel Erhebungen in der Uni, die muss man auch tabellarisch darstellen.“ (TP 08)

<sup>87</sup> „Ich habe bspw. an komplexe Excel-Tabellen gedacht.“ (TP 19)

tion "arithmetic operations like plus, minus, multiply or divided" or the term "basic arithmetic operations" could be used.

In addition, the example with the cheapest cell phone contract does not work, since mainly a comparison of monthly costs for flat rates is considered. In contrast to this probably rather a multi-level computation procedure (basic and consumption costs, possible bonus payments, etc.) might find consideration with the determination of the most favorable current offerer:

**"Perform calculations that require multiple steps or arithmetic operations such as addition, subtraction, multiplication or division, such as calculating the cheapest electricity provider for specific needs".**

**[„Berechnungen durchführen, die mehrere Schritte oder Rechenoperationen wie Plus, Minus, Mal oder Geteilt erfordern, wie z.B. den günstigsten Stromanbieter für bestimmte Bedürfnisse ausrechnen.“]**

Item e): No changes recommended

Item f) The item contains several stimuli and is complexly formulated. Many test persons have no concrete idea what it is all about. Therefore the formulation should be simplified, e.g. like this:

**"Create your own tables or graphics to summarize or illustrate information from different sources"**

**[„Eigene Tabellen oder Grafiken erstellen, um Informationen aus unterschiedlichen Quellen zusammenzufassen oder zu veranschaulichen“]**

Answer categories: For this question there was no indication that the default answer categories did not work. However, if the same scale is to be used for question 1 and question 2, the alternative answers suggested in question 1 are of course also applicable.

**Question to be tested:**

Kommen wir nun zu einigen Fragen bezüglich der Ausstattung Ihres Haushaltes.

[Let us now come to some questions regarding the equipment of your household.]

**3. Wie viele der folgenden Dinge gibt es bei Ihnen zu Hause?**

[How many of the following things are there in your home?]

*(INT.: Alles vorlesen. Nur eine Antwortalternative pro Abfrage)*

*[(INT.: Read all out loud. Only one answer alternative per query)]*

**Frequency distribution (N=20)**

	Keines [None]	Eins [One]	Zwei [Two]	Drei oder mehr [Three or more]
a. Fernseher [Television]	1	11	4	4
b. Computer (Desktop, Laptop oder Notebook) [Computer (Desktop, laptop or notebook)]	2	7	5	6
c. Tablet-Computer, z.B. iPad oder ein entsprechendes Tablet anderer Hersteller [Tablet computer, e.g. iPad or a corresponding tablet from other manufacturers]	11	7	1	1
d. E-Book-Reader, z.B. Kindle, Tolino oder ähnliche Produkte [E-Book-Reader, e.g. Kindle, Tolino or similar products]	16	4	-	-

**Cognitive Techniques:**

Comprehension Probing, Specific Probing.

**Findings:**

In this question all items were answered by all 20 test persons. Items c) and d) were rehearsed, the other items were only examined in more detail if difficulties were evident on the part of the test persons or spontaneous comments were made. While item a) did not cause any problems, item b) caused slight difficulties for three test persons (TP 02, 04, 09) because they were not sure whether tablet computers should be counted here. The fact that this is not clear to the test persons is also made clear by the fact that two further test persons (TP 16, 20), after they were explicitly asked about tablet computers in item c), have their answer to item b) corrected. They had mistakenly counted tablet computers as computers.

**Item c) Tablet computer, e.g. iPad or a corresponding tablet from other manufacturers**

A total of eleven test persons do not own a tablet computer. Nevertheless, almost all test persons know what is meant by this. Only test person 11, who also stated that they did not own one, could not

give a clear description of what they understood by a tablet computer. All other 19 test persons can do so without any problems. Here are some examples:

- *"A tablet computer is a simplified form of a laptop, but without a separate keyboard and touch screen."*<sup>88</sup> (TP 04)
- *"It's a mix of cell phone and laptop."*<sup>89</sup> (TP 10)
- *"Square and so flat and the keyboard is on the screen with it."*<sup>90</sup> (TP 16)

In response to the question of whether the test persons knew of any other tablet computers besides the iPad, 14 test persons were able to name additional manufacturers. The following tablet computers or their manufacturers were named most frequently:

- Samsung / Samsung Galaxy from 13 test persons
- Sony from 4 test persons
- Asus from 3 test persons

Further were named: Nokia, Toshiba, Acer, HP, Cat Nova, Android Tablets, Nexus, Grundig and Philips.

#### Item d) E-Book-Reader, e.g. Kindle, Tolino or similar products

Four test persons (TP 01, 04, 06, 20) stated that they had at least one e-book reader in their households. However, all but test person 11, who is not familiar with such a device, can explain what an e-book reader is:

- *"This is the one for the books you can download. Flat device to carry around."*<sup>91</sup> (TP 02)
- *"From Kindle I know this. This is a storage medium for several books, where you can read directly on it. Not suitable for playing or surfing."*<sup>92</sup> (TP 04)
- *"An e-book is an electronic book with a matt screen that digitally replaces the classic book."*<sup>93</sup> (TP 08)

Only three other e-book readers are named "Sony" and one "Acer", whereby test person 15 notes that any tablet computer can be used to read e-books.

#### Recommendations:

Question: No changes recommended.

Item c) The item with the iPad as the only example did not represent a problem for the test persons. The tablet from Samsung would be suitable as a further example, as it is used by more than half of the test persons as a further example. In

<sup>88</sup> „Ein Tablet-Computer ist eine vereinfachte Form eines Laptops, aber ohne separate Tastatur mit Touchscreen.“ (TP 04)

<sup>89</sup> „Das ist eine Mischung aus Handy und Laptop.“ (TP 10)

<sup>90</sup> „Viereckig und so flach und die Tastatur ist auf dem Bildschirm mit drauf.“ (TP 16)

<sup>91</sup> *"This is the one for the books you can download. Flat device to carry around."* (TP 02)

<sup>92</sup> „Von Kindle kenne ich das. Das ist ein Speichermedium für mehrere Bücher, wo man direkt drauf lesen kann. Nicht zum Spielen und Surfen geeignet.“ (TP 04)

<sup>93</sup> „Ein E-Book ist ein elektronisches Buch mit mattem Bildschirm, das digital das klassische Buch ersetzt.“ (TP 08)



order to avoid that test persons include tablet computers in their households in item b), we recommend changing the order of the items, first asking for item c) "tablet computers" and then for item b) "computers (desktop, laptop or notebook)".

Item d) Since the majority of the test persons do not know any other e-book reader than the Kindle or Tolino, we recommend to leave the item as it is and not to list further examples.

Answer categories: No changes recommended.

## Question to be tested:

Kommen wir nun noch zu einer Frage zu Ihrer Wohnung oder Ihrem Haus.

[Let us now turn to a question about your apartment or house.]

4. Wie viele Zimmer mit Badewanne oder Dusche gibt es bei Ihnen zu Hause?

[How many rooms with bath or shower are there in your home?]

(INT.: Antwortalternativen vorlesen!)

[(INT.: Read out answer alternatives!)]

## Frequency distribution (N=20)

Keines [None]	-
Eins [One]	17
Zwei [Two]	2
Drei oder mehr [Three or more]	1

## Cognitive Techniques:

General Probing.

## Findings:

All test persons could answer this question. 17 persons have a room with a bathtub or shower, two persons have two rooms each and one test person has three or more.

Six test persons (TP 03, 07, 09, 10, 12, 17) expressed problems with the understanding of the questions. When answering the question, these six test persons first thought about the number of rooms in their apartment, including a bathroom:

- *"I have a bedroom, living room, a bathtub and a kitchen."*<sup>94</sup> (TP 03)
- *"Does that include the hallway? Kitchen, bedroom, living room, bathroom. Four."*<sup>95</sup> (TP 07)
- *"With bathtub and shower? Included? I have a 2-room apartment. And with the bathtub it would be three. With my bath."*<sup>96</sup> (TP 09)
- *"Four rooms, kitchen, bathroom, toilet."*<sup>97</sup> (TP 12)

<sup>94</sup> „Ich habe Schlafzimmer, Wohnzimmer, eine Badewanne und eine Küche.“ (TP 03)

<sup>95</sup> „Zählt da der Flur auch mit? Küche, Schlafzimmer, Wohnzimmer, Bad. Vier.“ (TP 07)

<sup>96</sup> „Mit Badewanne und Dusche? Inbegriffen? Ich habe eine 2-Zimmer-Wohnung. Und mit der Badewanne wären es dann drei. Mit meinem Bad.“ (TP 09)

<sup>97</sup> „4-Zimmer, Küche, Bad, WC.“ (TP 12)

- *"How many bathrooms or how many rooms?"*<sup>98</sup> (TP 17)

Only when the question was repeated or when the cognitive interviewer asked questions, were the test persons able to answer the question correctly.

**Recommendations:**

Question: In order to make it easier for the interviewee to answer and to avoid misinterpretation of the term "room with bath or shower", the number of bathrooms with bath or shower should be asked directly:

**"How many bathrooms with bath or shower do you have at home?"**

Answer categories: No changes recommended.

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<sup>98</sup> „Wie viele Badezimmer oder wie viele Zimmer?“ (TP 17)

## Question to be tested:

Kommen wir nun noch zu einer Frage zur Computernutzung.

[Now we come to a question about computer use.]

5. Wie alt waren Sie, als Sie zum ersten Mal einen Computer benutzt haben?

[How old were you when you first used a computer?]

## Frequency distribution (N=20)

TP	Age	TP	Age
01	12	11 <sup>99</sup>	-
02	7	12	42
03	14	13	18 – 19
04	10	14	42
05	12	15	20
06	11	16	24
07	15	17	25
08	13	18	40 – 45
09	12 – 13	19	30
10	12 – 14	20	18

## Cognitive Techniques:

Information Retrieval Probing, Confidence Rating, Specific Probing.

## Findings:

All 20 test persons can remember when they first used a computer and give an approximate age:

- *"So I guess I was 7, I just know I was young and I always wanted to go because it was always my brother's turn."*<sup>100</sup> (TP 02, statement: 7 years)
- *"So we moved. If I think about it now, it could have been even earlier, maybe at the age of 12."*<sup>101</sup> (TP 10, statement: 12-14 years)

<sup>99</sup> Test person 11 has never used a computer before and can therefore not be listed here.

<sup>100</sup> *„Also ich vermute, ich war 7. Ich weiß nur, ich war jung und ich wollte auch immer dran, weil mein Bruder immer dran war.“* (TP 02)

<sup>101</sup> *„Da sind wir umgezogen. Wenn ich jetzt überlege, könnte es auch noch früher gewesen sein, vielleicht mit 12.“* (TP 10)

When asked, nine test persons (TP 03, 07, 08, 11, 12, 15, 17, 18, 19) are "very sure" and seven test persons (TP 01, 04, 09, 13, 14, 16, 20) are "rather sure" that they have used a computer for the first time at the given age. Test persons 02, 05, 06 and 10 are "rather unsure" when answering:

- *"Because it's been too long. I don't know if I was 6, 7, 8."*<sup>102</sup> (TP 02, statement: 7 years)
- *"Could also have been 10. At least in the '80s."*<sup>103</sup> (TP 05, statement: 12 years)
- *"We had a family computer. Come to think of it, it could have been even earlier...9 or 10. But I can't consciously say what age."*<sup>104</sup> (TP 06, statement: 11 years)

Test person 08 spontaneously expresses a difficulty in formulating the question: *"Used or needed? This is not understandable. There is a difference. I used it in the beginning for solitaire etc., I used it later."*<sup>105</sup> However, the test person can still give an answer and chooses the answer 13 years.

Similar abnormalities were observed in test persons 06 and 07. They relate their statements to the point in time when they worked on a computer for the first time, even though they had previously used a computer to play games:

- *"That must have been in 5th grade, so 11th. I just remembered when I got my first computer. We also had a family computer at home in elementary school, and I used to play there too."*<sup>106</sup> (TP 06, statement: 11 years)
- *"When I was a kid I had a computer and there were games on it. No, that's not meant here. The first time I worked on a computer was when I was old. 15, 16. It was a computer science course at school."*<sup>107</sup> (TP 07, statement: 15 years)

When asked about the make or model of the first computer they used, seven test persons (TP 01, 03, 07, 09, 13, 14, 16) state that they cannot remember it. In some cases they can only remember the software or operating system and not the exact brand or model. Test person 11 does not provide any information on this as he has never used a computer. The other twelve test persons (TP 02, 04, 05, 06, 08, 10, 12, 15, 17, 18, 19, 20) can remember the brand and/or model. From this it can be concluded that the latter group can remember back very precisely.

### Recommendations:

Question: We recommend to define the time of the first use of a computer more precisely by making clear whether the first work on a computer, in the sense of doing tasks, or the general first use of a computer, in the sense of e.g. playing on the computer, is meant and should be included, e.g. as follows:

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<sup>102</sup> *„Weil es schon zu lange her ist. Ich weiß nicht, ob ich 6, 7, 8 war.“* (TP 02)

<sup>103</sup> *„Könnte auch 10 gewesen sein. Jedenfalls in den 80ern.“* (TP 05)

<sup>104</sup> *„Wir hatten einen Familiencomputer. Wenn ich mir das recht überlege, könnte es auch noch früher gewesen sein...9 oder 10. Aber ich kann nicht bewusst sagen, welches Alter.“* (TP 06)

<sup>105</sup> *„Benutzt oder gebraucht? Das ist nicht verständlich. Das ist ein Unterschied. Benutzt habe ich ihn am Anfang für Solitaire etc., gebraucht habe ich ihn erst später.“* (TP 08)

<sup>106</sup> *„Das muss in der 5. Klasse gewesen sein also 11. Mir ist gerade eingefallen, wann ich meinen ersten Computer bekommen habe. Wir hatten auch in der Grundschulzeit einen Familiencomputer zuhause, da habe ich auch schon früher mal gespielt.“* (TP 06)

<sup>107</sup> *„Als Kind hatte ich mal einen Computer da waren so Spiele drauf. Nee, das ist hier nicht gemeint. Also das 1. Mal, dass ich an einem Computer gearbeitet habe war ich schon alt. 15, 16. Das war von der Schule aus ein Informatikkurs.“* (TP 07)

"How old were you when you first used a computer? It doesn't matter whether you used the computer for school, work, or just for games."

[„Wie alt waren Sie, als Sie zum ersten Mal einen Computer benutzt haben? Es ist dabei unerheblich, ob Sie den Computer für Ihre Schule, Arbeit oder einfach für Spiele nutzten.“]

Answer categories: Leave open questions, since the answers can be unfavorably categorized and each of the test persons can give an exact age indication.

**Question to be tested:**

Zum Schluss dieses Teils der Befragung möchten wir Ihnen noch Fragen zu Ihrer Person stellen.

[At the end of this part of the survey we would like to ask you some questions about yourself.]

6. Sind Sie derzeit in einer festen Beziehung?

[Are you currently in a steady relationship?]

**Frequency distribution (N=20)**

Ja [Yes]	13
Nein [No]	7

**Cognitive Techniques:**

Emergent Probing.

**Findings:**

Out of 20 test persons, 13 are in a fixed relationship and seven in no fixed relationship.

There were no significant comments on this question from the test persons. Nor did the test persons note any conspicuous features that indicate problems with the respondents' answers to the question.

**Recommendations:**

Question: No changes recommended.

Answer categories: No changes recommended.

## Question to be tested:

## 7. Wo haben Sie sich kennengelernt?

Bitte geben Sie Ihre Antwort anhand dieser Liste.

[Where did you meet?

Please give your answer based on this list.]

*(INT: Liste 2 vorlegen!)*

*[[INT: Present list 2!]]*

## Frequency (N=13, if question 6=yes)

a)	Schule [School]	1
b)	Ausbildung [Training]	-
c)	Beruf/Arbeitsplatz [Profession/Job]	2
d)	Hobby, Verein, Sport [Hobby, club, sport]	(1) <sup>108</sup>
e)	Kneipe, Disko, Veranstaltungen [Pub, disco, events]	2
f)	Feier/Party [Celebration/Party]	-
g)	Bekannten- oder Freundeskreis [Circle of friends or acquaintances]	1
h)	Familie/Verwandte [Family/relatives]	2
i)	Anzeigen/Inserate [Displays/advertisements]	-
j)	Internet [Internet]	2
k)	Urlaub [Holiday]	2
l)	Sonstiges: [Other:] Studies (TP 17)	1

## Cognitive Techniques:

General Probing, Specific Probing

<sup>108</sup> Test persons 18 chose both answer c) and answer d), although multiple answers are not desired.



### Findings:

All test persons who live in a relationship could assign themselves to a category.

The answer category "other" was chosen once (TP 17) because the test person could not clearly classify "study". In this case the category "training" was disregarded. *"This was in study, but it is not written here. So other: study."*<sup>109</sup> (TP 17)

Furthermore, one test person stated that random events, such as shopping, were missing. The same person was able to classify herself into two categories, so that a multiple choice was made (TP 18): *"Job/workplace or hobby and club also. These were both common things. Applies to both."*<sup>110</sup>

### Recommendations:

Question: No changes recommended.

Answer categories: In order to facilitate a correct assignment of respondents, the option "studies" could be explicitly included in category b). Even if there were no further mentions under "Other", we recommend to keep a residual category.

In addition, each answer category should be formulated to match the question:

- 
- a) In school [In der Schule]
  - b) During studies/ vocational training [Im Studium/ in der Berufsausbildung]
  - c) In the workplace/ at work [Am Arbeitsplatz/ im Beruf]
  - d) Through a hobby, in a club, at sports [Durch ein Hobby, in einem Verein, beim Sport]
  - e) In the pub / disco, at an event [In der Kneipe/ Dis-ko, bei einer Veranstaltung]
  - f) At a celebration/party [Auf einer Feier/Party]
  - g) Among friends or acquaintances [Im Bekannten- oder Freundeskreis]
  - h) Through family/relatives [Über Familie/Verwandte]
  - i) Via ads/advertisements [Über Anzeigen/Inserate]
  - j) On the Internet [Im Internet]
  - k) On holiday[Im Urlaub]
  - l) In a different environment, namely  
 [In einem anderen Umfeld, und zwar \_\_\_\_\_]
- 

<sup>109</sup> „Das war im Studium, aber das steht hier nicht. Also sonstiges: Studium.“ (TP 17)

<sup>110</sup> „Beruf/Arbeitsplatz bzw. Hobby und Verein auch. Das waren beides gemeinsame Sachen. Trifft beides zu.“ (TP 18)

## 5 Cognitive Techniques

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<b>Think Aloud</b>	Technique of thinking aloud: <i>„Please vocalize everything that comes to your mind while you answer the following question. Please also vocalize things that seem unimportant to you. The question is...“.</i>
<b>Comprehension Probing</b>	Questions on understanding, e.g.: <i>„What do you understand by ‘a highly responsible professional activity’ in this question? “</i>
<b>Category Selection Probing</b>	Question about the choice of answer category, e.g.: <i>„You have said that you ‘fully’ agree with this statement. Why did you choose this answer?“</i>
<b>Information Retrieval Probing</b>	Questions on how information was obtained, e.g.: <i>„How did you remember that you had been to the doctor for the last 12 months?“</i>
<b>General/Elaborative Probing</b>	Non-specific questions, e.g.: <i>„Could you please explain your answer a little more?“</i>
<b>Specific Probing</b>	Specific questions, e.g.: <i>„You answered ‘yes’ in this question. Does this mean that you have already given up on career opportunities for your family, or that you might be willing to give them up but have not yet done so?“</i>
<b>Emergent Probing</b>	Spontaneous questioning in response to an utterance or behavior of the test person, e.g.: <i>„You just frowned and laughed when I read you the answer options. Can you please explain to me why you did that?“</i>
<b>Difficulty Probing</b>	How easy or difficult was it for you to answer this question?  <i>If rather/very difficult:</i> <i>„Why did you find the answer to this question rather difficult / very difficult?“</i>
<b>Paraphrasing</b>	Test persons reproduce the question text in their own words: <i>„Please repeat the question I read to you in your own words.“</i>
<b>Confidence Rating</b>	Assessment of the reliability of the response, e.g.: <i>„How sure are you that you’ve seen a doctor in the last 12 months?“</i>