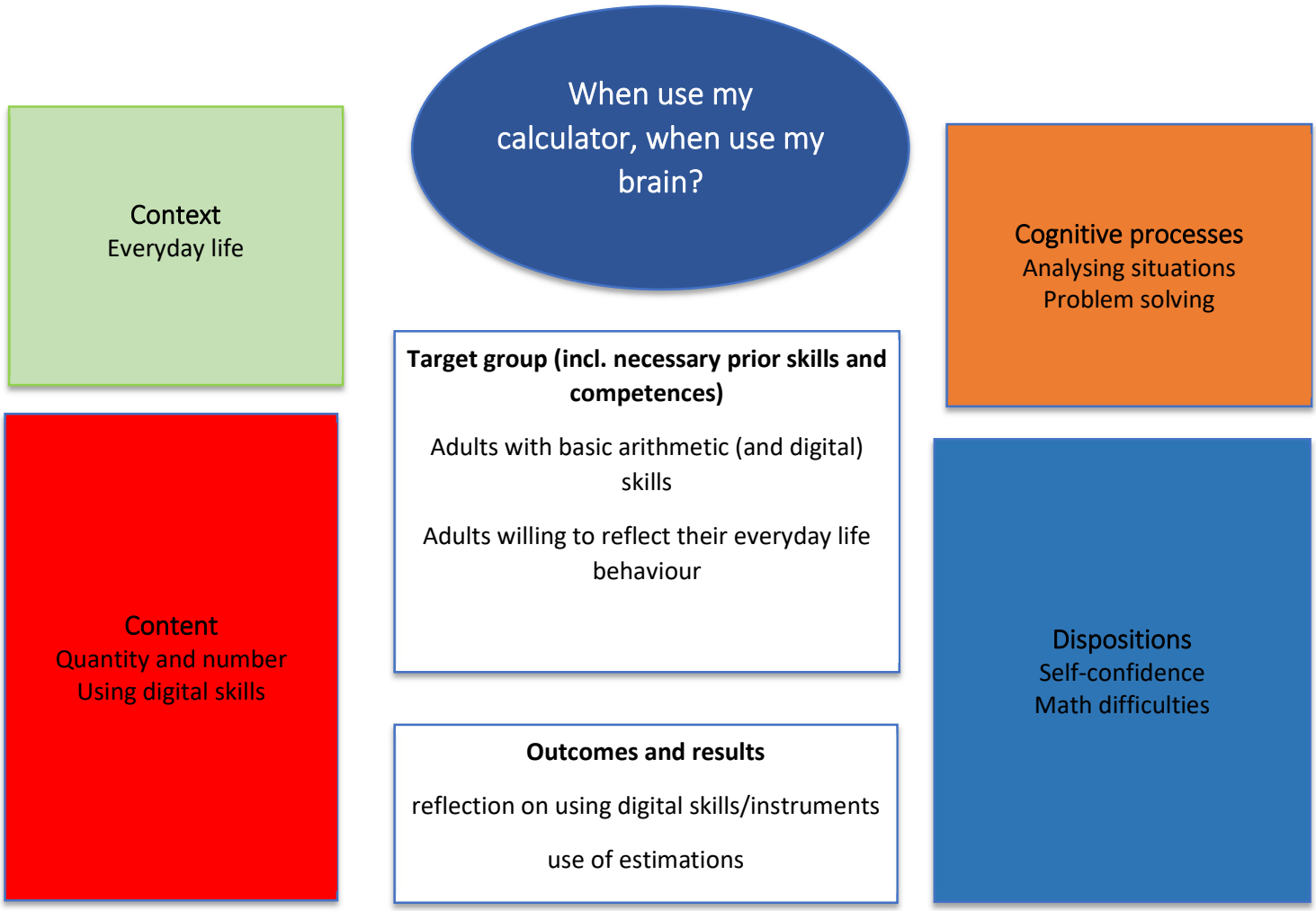
MY CALCULATOR IS ONLY PART OF THE SOLUTION

How to (not) use a calculator…

4x4
180-99 seats still free
half priced jeans ~~€ 150,-~~

No need to scratch one's head,
as long as one has a calculator (or mobile phone) ready to be used?
Machines, apps and artificial intelligence are part of our everyday life – and they will be even more in the future, we suppose. This mean, we have to get in touch with them, use them when practical and – over all – have a critical and reflective eye on when using them.

Overview "My calculator is only part of the solution?"



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Main information

Content	Quantity and number, depending on the pre-knowledge of the learners. Using digital skills in a meaningful and useful way Judging digital solutions critically Estimations and back-of-the-envelope calculations
Target group	Adults with basic arithmetic (and digital) skills Adults willing to reflect their everyday life behaviour with regards to using either digital devices or their brain to do (basic) numeracy decisions
Learning intention	Numeracy skills for practical and personal purposes in daily life
Duration	Approx. 5 lessons
Material and resources	calculator worksheets (see appendix) optional: digital tools
Group size	About 10 learners
Problem statement	Many learners are not aware that a calculator cannot replace basic mathematical skills. The results, for example from a calculator, are often accepted as correct and true without reflection or critical thinking. Estimations and mental calculations are essential tools in everyday mathematics.
Working questions	Do you use a calculator/your mobile phone very often? In which situations do you use such device? Is this use always necessary in your eyes? Do you control the solution the device gives you? How can we control those solutions by using our brain? What do I need to correctly make use of a calculator?
Learning outcomes and results	Learners use estimations and rough calculations Learners recognize the limits of device assisted calculation Learners transfer skills to personal and private life.
Reference to National Qualification Frame	Optional (country's decision)

Working plan

Time (lessons)	Description of content/activities	Material	Methodical and didactic information[1]
10 minutes	**Phase 1: Discover** Activation and placing the learners in the situation: Discussion about the purpose and benefits of a calculator, explaining that a calculator is a useful tool for performing complex calculations quickly, but it does not encompass all aspects of mathematical thinking.	optional: a calculator for demonstration	*HITS* questioning structuring lessons metacognitive strategies
40 minutes +	**Phase 2a: Devise** Give hints on how to check the calculator's result by estimation (rounding, using tens instead of 9s or 8s, using divisions (by 2, 10, …) to estimate percentages etc) and back-of-the-envelope calculation. Learners are asked to decide within a few seconds if a calculation is correct or not /which calculation is correct using the strategies mentioned above. Example: An inheritance of € 12.430 must be shared between 9 heirs. Everyone gets € 1381,11. Correct or incorrect? or An inheritance of € 12.430 must be shared between 9 heirs. Everyone gets… a) € 1381,11 b) € 138,11 c) € 1211,11	Depending on pre-knowledge of the learners those strategies can be developed or assisted by Montessori material, visualizing fractions and others	*HITS* setting goals demo tasks cognitive activation collaborative learning questioning metacognitive strategies

[1] for description and explanation of kinds of tasks, HITS and other background information please consult the teacher's/user's guide

30 minutes	**Phase 2b: Devise** Challenge: Brain vs. calculator The learners engage in a challenge in pairs, where one partner uses a calculator and the other does not. One task is solved after another, and each time it is noted whether mental calculation or the calculator is faster. In a feedback round the results and outcomes are discussed. This phase can be introduced by a discussion on the learners' assumptions.	Worksheet with tasks for challenge – see appendix 1 alternatively, those tasks can also be put in a digital presentation (e.g. platform Kahoot!)	pair work *HITS* collaborative learning metacognitive strategies feedback
50 minutes	**Phase 3: Develop** The learners are given tasks that cover various mathematical concepts and skills (according to their level and skills) which require e.g. an understanding of basic arithmetic operations, fraction calculations, percentages or equation solving. By discussing and solving such tasks, the learners will realize that a calculator cannot replace fundamental mathematical skills in these tasks. At least one task is driven as a demo task.	Different tasks for discussing and solving – see appendix 2 presenting some suggestions to be chosen, adapted and expanded to the teacher's and the learners' discretion	*HITS* collaborative learning metacognitive strategies feedback
	Phase 4: Defend Reflexion and discussion: Learners conclude their experiences and findings. Teachers and learners underline that a calculator and other devices are useful – but need to be used critically. Only a person with competence in numeracy is able to use a calculator correctly and effectively. Learners feel empowered to correctly make use of a calculator.		mathematical talk *HITS* Questioning Feedback

Suggestions for the teacher/user

The example presented here should be considered as exemplary and inspirational material presenting a guideline with a high range of possibilities of adapting those suggestions to a specific group of learners or an individual learner with his or her very personal requirements.

In concrete terms, this example could be adapted these ways:

- Duration and individualization: Like mentioned above, it can be necessary to assist the group of learners or part of the group if they have not already developed strategies of estimation or rough calculations sufficiently. It is absolutely recommended to use visualizing material in this case.
- Level of difficulty: Especially the example tasks presented in appendix 2 need to be closely adapted to the learners' competences and skills. It is possible to work on the topic of correct use of a calculator within very different levels of numeracy skills, but it is, of course, important for the teacher to choose and develop convenient tasks for his or her group of learners.

Our educational activities aim at numeracy skills being not only memorized, but first of all being practiced and functionally used by the learners in daily life or/and vocational situations. It is therefore recommended to implement the idea of HITS[2] (higher impacts of teaching skills) as far and often as possible: ...

- ... work with concrete and authentic material that learners will recognize from everyday life situations. This also means that the learners should use the device they normally use in their everyday life (a calculator, their mobile phones or others).
- ... ask the learners questions and let them raise questions themselves. It can be crucial to discuss numeracy themes, contexts, and numbers. Depending on their individual competences in mental arithmetic, learners will have very different points of views when it comes to the question if device assisted calculation is meaningful in a concrete situation. These different opinions and views can lead to rich discussions.
- ... think of possible ways of transfer. Teachers should empower their learners to transfer experiences and findings of this lesson into their personal everyday lives with concrete possibilities of application (e.g. estimating the amount of your purchase in the supermarket,

[2] For general information and explanation on HITS please see the teacher's/user's guide

Appendix 1

Worksheet "Brain versus calculator" (ad phase 2b)

brain
versus
calculator

A calculator may help you solve calculations quickly. But is it always worth to use it?

Try it out with a partner – one uses a calculator, the other one not:

Which tasks can be calculated faster with / without calculator?

Highlight tasks without calculator in green, those with calculator in red.

green/red		green/red	
❍	6 * 7 =	❍	85 458 + 51 149 =
❍	183 + 299 =	❍	92 585 – 21 585 =
❍	18 648 + 84 572 =	❍	3 + 854 591 =
❍	107 440 / 84 572 =	❍	524 * 99 =
❍	84 584 – 84 000 =	❍	32 154 + 9 584 =
❍	17 * 23 =	❍	85 452 – 65 245 =
❍	854 587 – 1999 =	❍	11 * 36 =
❍	8 545 / 5 =	❍	808 201 / 899 =
❍	895 700 / 100 =	❍	500 000 – 250 =
❍	20 + 3 =	❍	18 / 3 =

Appendix 2

Different tasks for discussing and solving (ad phase 3)

Example 1: Discount calculations

A store offers a 25% discount on all items. The learners are supposed to calculate the price of an item before and after the discount. They need to apply percentage calculations and have a command of basic arithmetic operations.

Example 2: Fraction calculations

The learners are required to solve a task that involves fraction calculations. For example: A cake is divided into 8 pieces, and a person eats 3/8 of the cake. The learners should calculate how much cake remains. Understanding fractions and solving arithmetic operations with fractions is necessary for this task.

Example 3: Geometry

The learners should solve a geometric problem, such as calculating the area or perimeter of a rectangular plot of land. They need to apply the corresponding formulas and have a command of multiplication and addition.

Example 4: Percentage calculations

The learners should solve a task involving percentage calculations, such as calculating the tip at a restaurant. They are given the total amount of the bill and need to calculate a specific percentage as a tip. Understanding percentages, multiplication, and addition is necessary for this task.

Example 4: Solving Equations

The learners should solve a simple equation, such as $2x + 5 = 13$. They need to have a command of basic arithmetic operations and understand the principles of solving equations in order to determine the value of x.