



Case Study 01

Basic data

Title of Research Teaching Unit	Shopping (Discounts and Sales)
Unit created by	BORG Deutsch-Wagram (AT)
Based on Concept	Discounts and Sales
Concept created by	Univerzita Karlova (CZ)
Date of teaching	15.05.2024
Number of students in class	23
Number of migrant students	11

1. Unit Description of Research Teaching Unit

Title	Shopping (Discounts and Sales)
Age of students/grade	12 years
Length of the unit	2 x 50 minutes
Mathematical topic	Application of percentages in everyday life (shopping)
Prerequisite knowledge	<ul style="list-style-type: none">• Calculations with fractions• Manipulations of expressions• Solving simple equations
Materials needed	<ul style="list-style-type: none">• Work sheet “Percentage in everyday life 1” (for lesson 1)• Work sheet “Percentage in everyday life 2” (for lesson 2)
Objectives	<p>The student</p> <ul style="list-style-type: none">• can apply mathematics in real-world problems with percentages• has improved financial literacy• understands the concept of discount in a shop• can analyse data in a travel agency flyer and in a shopping receipt• can cooperate with another student to solve problems
Notes on work with migrant students	<ul style="list-style-type: none">• Students (migrant and non-migrant) can bring flyers from shops they or their families frequent

Lesson plan:**Lesson 1 (50 minutes)**

Time	Method	Content and comments
ca. 10 min	Exposition and Teacher-student-communication	The teacher motivates the students for the topic of the lesson and describes the importance of percentages in everyday life. The teacher explains the mathematical notations and equations on the blackboard. Students fill the gaps in the corresponding boxes of the work sheet.
ca. 25 min	Partner work	The students solve the tasks of the work sheet in partner work (2 students). The teacher supports the teams if required.
ca. 15 min	Teacher-student-communication	Comparison of the results

Lesson 2 (50 minutes)

Time	Method	Content and comments
ca. 20 min	Exposition and Teacher-student-communication	The teacher motivates the students for the topic of the lesson and describes the importance of percentages in everyday life. Explanation on the blackboard and solving of the demonstration task.
ca. 15 min	Partner work or small-group work	The students solve the tasks of the work sheet in partner work (2 students). The teacher supports the teams if required.
ca. 15 min	Teacher-student-communication	Comparison of the results

Percentages in everyday life 1 – Work sheet



What I should remember ...

The word “percent” derives from the Latin „pro cento“ and means „of hundred“.

$$1\% = \frac{1}{100}$$

There are three important terms (words) in the calculation with percentages:

Base G	Percentage p	(Absolute) Share A
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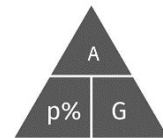
The base G describes the whole, i.e. the absolute value corresponding to 100 %.

The percentage p is the relative share (ratio) described in percent (%).

The absolute share A is the part of the whole corresponding to p %.

Between the values G , p and A there is the following correlation

$$A = \frac{G}{100} \cdot p$$



Absolute share A	Percentage p	Base G

Demonstration task 1:

Calculate 24% of 2 840€.

Demonstration task 2:

Family Huber spends 370 Euro each month on food. This is 12 percent of their income.

Calculate the income of Family Huber.

Demonstration task 3:

A certain pair of brand jeans normally cost 150 Euros in a shop. In a current sale one receives a 20 % discount. Calculate how much money one saves if one buys the jeans during this sale.

Task 1:

Write in the empty box whether this is the base G , the absolute share A or the percentage p .

... is the part of the whole as an absolute value	
... is the relative share, recognizable by a percentage symbol	
... describes the whole	

Task 2:

In the following sentences, mark the base G in yellow, the absolute share in blue, and the percentage in red.

- A girl paid just 50 % of the original price. She paid 40 €. The skateboard would have originally cost 80 €.
- Julian received 2 Euros more pocket money this month. This is 5 % more than last month. Last month he received 40 Euros pocket money.
- A bicycle costs 750 € and is discounted 10 %. Therefore, one saves 75 €.

Task 3:

Complete the missing values in the table. If needed, round to 2 decimals. Decide for yourself whether you use the equation or the unitary method (Rule of Three). Give a comprehensible explanation for each sub-task.

	Base	Absolute share	Percentage
a)	250 €	50 €	_____
b)	1350 €	_____	12 %
c)	_____	123 €	27 %
d)	2 345 €	_____	60 %

Task 4:

The history of the Viennese coffee house began at the end of the 17th century. Marble tables on which the coffee is served are typical of a Viennese coffee house. However, Austrians also love to drink coffee at home and are all the happier when it is discounted in a supermarket.

A 500 g pack of coffee costs 6.99 € in a supermarket. Once a month, the price of coffee is reduced by 25 %. Calculate how much you can save when you buy during the sales and how much the coffee costs afterwards.

**Task 5:**

Karin has shopped in the sale. She bought two T-shirts for 15 € each, a dress for 35 €, and a bag for 54 €. The clothes were 20 % discounted, and the bag even 30 %. How much has Karin saved in total?

Percentages in everyday life 1 – Work sheet with solutions



What I should remember ...

The word “percent” derives from the Latin „pro cento“ and means „of hundred“.

$$1\% = \frac{1}{100}$$

There are three important terms (words) in the calculation with percentages:

Base G	Percentage p	(Absolute) Share A
----------------------------	----------------------------------	--

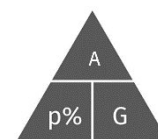
The base G describes the whole, i.e. the absolute value corresponding to 100 %.

The percentage p is the relative share (ratio) described in percent (%).

The absolute share A is the part of the whole corresponding to p %.

Between the values G , p and A there is the following correlation

$$A = \frac{G}{100} \cdot p$$



Absolute share A	Percentage p	Base G
$A = \frac{G}{100} \cdot p$	$A = \frac{G}{100} \cdot p \quad \cdot 100$ $A \cdot 100 = G \cdot p \quad : G$ $\frac{A \cdot 100}{G} = p$	$A = \frac{G}{100} \cdot p \quad \cdot 100$ $A \cdot 100 = G \cdot p \quad : p$ $\frac{A \cdot 100}{p} = G$

Demonstration task 1:

Calculate 24% of 2 840€.

100 % 2 840 €

1 % 28.40 €

24 % x €

$$x = \frac{2840}{100} \cdot 24 = \mathbf{681.60}$$

Demonstration task 2:

Family Huber spends 370 Euro each month on food. This is 12 percent of their income.

Calculate the income of Family Huber.

Known: 370 € ... absolute share, and 12 % ... percentage

Calculation using the equation:

$$G = \frac{A \cdot 100}{p}$$

$$G = \frac{370}{12} \cdot 100 = \mathbf{3\,083.33\text{€}}$$

Calculation using the unitary method (Rule of Three):

12% 370 €

1% ... 30.83 €

100 % ... **3 083.33€**

Demonstration task 3:

A certain pair of brand jeans normally cost 150 Euros in a shop. In a current sale one receives a 20 % discount. Calculate how much money one saves if one buys the jeans during this sale.

100 % 150 €

1 % 1.50 €

20 % x €

$$x = \frac{150}{100} \cdot 20 = \mathbf{30}$$

Answer:

One can save 30 €. Therefore, the pair of jeans only cost 120 €.

Task 1:

Write in the empty box whether this is the base G , the absolute share A or the percentage p .

... is the part of the whole as an absolute value	A
... is the relative share, recognizable by a percentage symbol	p
... describes the whole	G

Task 2:

In the following sentences, mark the base G in yellow, the absolute share in blue, and the percentage in red.

- A girl paid just 50 % of the original price. She paid 40 €. The skateboard would have originally cost 80 €.
- Julian received 2 Euros more pocket money this month. This is 5 % more than last month. Last month he received 40 Euros pocket money.
- A bicycle costs 750 € and is discounted 10 %. Therefore, one saves 75 €.

Task 3:

Complete the missing values in the table. If needed, round to 2 decimals. Decide for yourself whether you use the equation or the unitary method (Rule of Three). Give a comprehensible explanation for each sub-task.

	Base	Absolute share	Percentage
a)	250 €	50 €	20 %
b)	1350 €	162 €	12 %
c)	455.56 €	123 €	27 %
d)	2 345 €	1407 €	60 %

Task 4:

The history of the Viennese coffee house began at the end of the 17th century. Marble tables on which the coffee is served are typical of a Viennese coffee house. However, Austrians also love to drink coffee at home and are all the happier when it is discounted in a supermarket.

A 500 g pack of coffee costs 6.99 € in a supermarket. Once a month, the price of coffee is reduced by 25 %. Calculate how much you can save when you buy during the sales and how much the coffee costs afterwards.



$$\begin{array}{l} 100 \% \dots 6.99 \text{ €} \\ 1 \% \dots 0.0699 \text{ €} \\ 25 \% \dots x \text{ €} \end{array}$$

$$x = \frac{6.99}{100} \cdot 25 = 6.99 \cdot 0,25 = 1.7475 \text{ €}$$

Answer:

You can save 1.7475 € during the sales. This means that the 500 g pack of coffee still costs 5.2425 €, or around 5.24 €.

Task 5:

Karin has shopped in the sale. She bought two T-shirts for 15 € each, a dress for 35 €, and a bag for 54 €. The clothes were 20 % discounted, and the bag even 30 %. How much has Karin saved in total?

Total cost of the clothes: $2 \cdot 15 \text{ €} + 1 \cdot 35 \text{ €} = 65 \text{ €}$

20 % of 65 € are 13 €.

30 % von 54 € are 16.20€

Answer:

Karin has saved 29.20 €.



What I should remember ...

Increase and decrease

(1) A T-Shirt's production costs 20 €. In the shop, it is sold for 2 % more. How much does it cost in the shop?

(2) A winter jacket costs 180 €. After winter ends, it shall be sold 5 % cheaper.
How much does it cost after winter?

If a number a is increased by p %, it is multiplied with the factor $\left(1 + \frac{p}{100}\right)$.

If a number a is decreased by p %, it is multiplied with the factor $\left(1 - \frac{p}{100}\right)$.

Applying percentages consecutively

(3) A T-Shirt's production costs 20 €. In the shop, it is sold for 10 % more.
At a sale, the customer gets a 10 % discount. How much does the T-Shirt cost now?

If several percentages are calculated consecutively, the result of the previous calculation will be the base of the new calculation.

Task 1:

Match the correct mathematical calculations with the corresponding tasks. For each task, there is only one correct calculation here.

A travel bag, originally priced at 40 €, are going to be ...

	Calculation	Letter
a) ... cheapened by 10 %		
b) ... cheapened by 25 %		
c) ... raised by 10 %		
d) ... first raised by 10 %, then cheapened by 10 %		
e) ... raised by 10 €		
f) ... first raised by 25 €, then cheapened by 5 €		
g) ... first cheapened by 20 %, then raised by 10 %		

M	$40 \cdot 0,10$
H	$40 + 0,10$
R	$40 \cdot 1,10$

H	$40 \cdot 0,90 \cdot 0,10$
P	$40 \cdot 0,90$
C	$40 \cdot 0,90 \cdot 1,10$

E	$40 + 10$
A	$40 \cdot 0,25$
T	$40 \cdot 0,88$

E	$40 \cdot 0,75$
X	$40 : 0,25$
N	$40 - 20$

Task 2:

Solve the following word problems.

- a) A jacket costs 72.22 € after a 10 % price decrease. Calculate the original price of the jacket.
- b) A trouser costs 70.08 € including 20 % VAT (value-added tax). Calculate the price without the tax.

Task 3:

VAT (value-added tax) for food articles in Austria is 10 %. In Spain, it is only 4 %. Looking at the given receipt from a grocery store in Austria, the total sum is 9.75 € (including VAT). Assuming the net costs (without tax) would be the same, how much would one have to pay for this purchase in Spain?

Find out how much the VAT is in your country of origin (or a country that you have visited) and calculate, how much one would have to pay for this purchase in that country.

Schokopudding	B	1.19
Aktionsnachlass	B	-0.20
Cabanossi	B	2.49
Magnum Caramel	B	1.30
Reisessig	B	1.99
Reisessig	B	1.99
Zucker	B	0.99
Summe	EUR	9.75
Gegeben Karte		9.75
Maestro		
B E Z A H L T	EUR	9,75
17077830 017563 016391 20150919 143457		
PAN:*****2076 12/16 D01		
EA000000043060		
MAESTRO CONTACTLESS		
Betrag dankend erhalten		
B : 10% MwSt von	8.86 =	0.89



What I should remember ...

Increase and decrease

(3) A T-Shirt's production costs 20 €. In the shop, it is sold for 2 % more. How much does it cost in the shop?

$$\begin{array}{l} 100 \% \dots 20 \text{ €} \\ 1 \% \dots 0.20 \text{ €} \\ 102 \% \dots x \text{ €} \end{array}$$

$$x = \frac{20}{100} \cdot 102 = 20 \cdot 1.02 = \mathbf{20.40}$$

Note:

If the T-Shirt is 2 % more expensive, one has to pay 102 % instead of 100 % of the original price.

Answer:

The T-Shirt costs 20.40 € in the shop.

(4) A winter jacket costs 180 €. After winter ends, it shall be sold 5 % cheaper. How much does it cost after winter?

$$\begin{array}{l} 100 \% \dots 180 \text{ €} \\ 1 \% \dots 1.80 \text{ €} \\ 95 \% \dots x \text{ €} \end{array}$$

$$x = \frac{180}{100} \cdot 95 = 180 \cdot 0.95 = \mathbf{171}$$

Note:

If the jacket is 5 % cheaper now, one has to pay 95 % instead of 100 % of the original price.

Answer:

The jacket costs 171 € after winter.

If a number a is increased by p %, it is multiplied with the factor $\left(1 + \frac{p}{100}\right)$.

If a number a is decreased by p %, it is multiplied with the factor $\left(1 - \frac{p}{100}\right)$.

Applying percentages consecutively

(4) A T-Shirt's production costs 20 €. In the shop, it is sold for 10 % more. At a sale, the customer gets a 10 % discount. How much does the T-Shirt cost now?

$$\begin{array}{l} 100 \% \dots 20 \text{ €} \\ 1 \% \dots 0.20 \text{ €} \\ 10 \% \dots x \text{ €} \end{array}$$

$$x = \frac{20}{100} \cdot 10 = 20 \cdot 0.10 = \mathbf{2}$$

Note:

If the T-Shirt is 10 % more expensive, one has to pay 110 % instead of 100 % of the original price. Consequently, one gets a new base. If the T-Shirt gets cheaper now by 10 %, those 10 % have to be calculated from the new base.

Answer:

After the increase, one pays 22 €. After the discount, one pays 19.80 €. The final price for the T-Shirt is therefore 19.80€.

$$\begin{array}{l} 100 \% \dots 22 \text{ €} \\ 1 \% \dots 0.22 \text{ €} \\ 10 \% \dots x \text{ €} \end{array}$$

$$x = \frac{22}{100} \cdot 10 = 22 \cdot 0.10 = \mathbf{2.2}$$

In short: New price = $20 \cdot 1.10 \cdot 0.90 = 19.80 \text{ €}$

If several percentages are calculated consecutively, the result of the previous calculation will be the base of the new calculation.

Task 1:

Match the correct mathematical calculations with the corresponding tasks. For each task, there is only one correct calculation here.

A travel bag, originally priced at 40 €, are going to be ...

	Calculation	Letter
a) ... cheapened by 10 %	$40 \cdot 0,90$	P
b) ... cheapened by 25 %	$40 \cdot 0,75$	E
c) ... raised by 10 %	$40 \cdot 1,10$	R
d) ... first raised by 10 %, then cheapened by 10 %	$40 \cdot 0,90 \cdot 1,10$	C
e) ... raised by 10 €	$40 + 10$	E
f) ... first raised by 25 €, then cheapened by 5 €	$40 - 20$	N
g) ... first cheapened by 20 %, then raised by 10 %	$40 \cdot 0,88$	T

M	$40 \cdot 0,10$
H	$40 + 0,10$
R	$40 \cdot 1,10$

H	$40 \cdot 0,90 \cdot 0,10$
P	$40 \cdot 0,90$
C	$40 \cdot 0,90 \cdot 1,10$

E	$40 + 10$
A	$40 \cdot 0,25$
T	$40 \cdot 0,88$

E	$40 \cdot 0,75$
X	$40 : 0,25$
N	$40 - 20$

Task 2:

Solve the following word problems.

- c) A jacket costs 72.22 € after a 10 % price decrease. Calculate the original price of the jacket.

$$x \cdot 0.90 = 72.22 \rightarrow x = 80.24\text{€}$$

- d) A trouser costs 70.08 € including 20 % VAT (value-added tax). Calculate the price without the tax.

$$x \cdot 1.20 = 70.08 \rightarrow x = 58.50\text{€}$$

Task 3:

VAT (value-added tax) for food articles in Austria is 10 %. In Spain, it is only 4 %. Looking at the given receipt from a grocery store in Austria, the total sum is 9.75 € (including VAT). Assuming the net costs (without tax) would be the same, how much would one have to pay for this purchase in Spain?

$$x \cdot 1.20 = 9.75 \rightarrow x \approx 8.86\text{€} \dots \text{Price in Austria without tax}$$

Assuming "Price in Austria without tax" = "Price in Spain without tax", one gets:

$$\text{Price in Spain with tax: } 8.86 \cdot 1.04 = 9.2144\text{€} \approx 9.21\text{€}$$

Schokopudding	B	1.19
Aktionsnachlass	B	-0.20
Cabanossi	B	2.49
Magnum Caramel	B	1.30
Reisessig	B	1.99
Reisessig	B	1.99
Zucker	B	0.99
Summe	EUR	9.75
Gegeben Karte		9.75
Maestro		
B E Z A H L T	EUR	9.75
17077830 017563 016391 20150919 143457		
PAN:*****2076 12/16 D01		
FA0000000043060		
MAESTRO CONTACTLESS		
Betrag dankend erhalten		
B : 10% MwSt von	8.86 =	0.89

Find out how much the VAT is in your country of origin (or a country that you have visited) and calculate, how much one would have to pay for this purchase in that country.

2. Interview Analysis

The teacher teaching this unit has 9 years teaching experience. Her second subject is Psychology/Philosophy. She did not receive any particular training about teaching in multicultural classrooms.

The teacher first considered the tasks of this unit as too easy, particularly the demonstration tasks. The tasks where the students are supposed to work independently in partner work were considered ok with respect to difficulty.

The teacher positively mentioned the task with the food receipt (Work sheet 2, Task 3). During the teaching, there actually were students with migrant background, in whose original countries the VAT is different from Austria. These students were very motivated to find out the VAT in their original countries and contribute this information to the work on this task. The information was then also conveyed to the whole class at the end of the lesson.

The teacher explained why she changed two of the originally proposed tasks. In Work Sheet 2, Task 1, she changed the object to be bought from a pair of sneakers to a travel bag, considering this to be of more interest to students. In Work Sheet 1, Task 4, the original proposal was for a vacation trip from a travel agency. She considered this to be not such a good context, since the trip was fairly expensive and not in the life reality of a lot of students. The context was changed by her to shopping for coffee as detailed in the work sheet above.

3. Improvement Suggestions

The teacher recommended several improvements to the unit:

First recommendation were the changes in the tasks that are mentioned in the interview analysis, to more conform to the interests and realities of the life of the students in this school.

The next suggestion was to add an additional task at the beginning (after demonstration tasks 1-3), that is a bit harder than these tasks.

And the final suggestion was to have more tasks like Work Sheet 1, Task 2, where students can practice identifying the correct information in the given text of a word problem. She suggested also doing this with word problems where there is extra information (i.e. more information than is needed to solve the task).