

HANDBOOK FOR TEACHERS

Guidelines for planning and delivering successful, innovative and inclusive teaching, with a focus on computer-supported collaborative learning

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INTRODUCTION

This Handbook was developed within the project **CO-CREATE: Computer-Supported Collaborative Learning for Inclusive Education**[1] (2024-1-RS01-KA220-SCH-000253208), which aims to develop innovative educational materials and to support secondary school teachers in applying them, thus ensuring that all students, including gifted students and students with special educational needs and disabilities (SEND), have access to high-quality, stimulating and collaborative learning experiences.

The project is implemented by two higher education institutions: the University of Belgrade (UB), Serbia (coordinator), and Universitat Pompeu Fabra (UPF), Spain; two non-governmental organisations: The Loop Foundation (LF), Serbia, and the Centre for Technical Culture Rijeka (CTC Rijeka), Croatia; and one school, AEFafe, Portugal.

Using a design-based research (*Design-Based Research*, DBR) methodology, which brought together students, teachers and education experts from four countries – Croatia, Portugal, Serbia and Spain – and building on the national Informatics / Computer Science curricula, the CO-CREATE team developed four lessons that promote not only students' acquisition of subject knowledge, but also the development of their communication, teamwork and presentation skills. The lessons are available on the open e-learning platform of the Petlja Foundation (Table 1).

Table 1. Co-CREATE lessons

Lesson name	**Lesson objectives**	**Students' age group**	**Duration (minutes)**	**Link**[2]
Data analysis and visualisation – creating pivot tables and charts	For students to learn to (collect, where necessary), organise, group, filter and visually represent data using tables and bar, pie and line charts	13–18	90	petlja.org/sr-Latn-RS/kurs/19359/0

1 Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them. 2 The platform's basic features do not require registration: you can explore a course by clicking the "View the course now" button in the bottom right-hand corner of the screen. Creating an account and logging in are only necessary if you want to create your own class, follow each student's work and assess them through the system.

Lesson name	Lesson objectives	Students' age group	Duration (minutes)	Link[2]
Introduction to cryptography with loops	For students, building on their knowledge of conditions and loops, to learn to encrypt and decrypt messages using the Caesar, Scytale and XOR tools	15–18	90	petlja.org/sr-Latn-RS/kurs/19717/0
Disassembling and assembling a computer	For students to learn to disassemble and reassemble a computer, identify its components and produce clear and accurate technical documentation of the whole process	13–18	120	petlja.org/sr-Latn-RS/kurs/19631
Computer structure – hardware and software	For students to learn to recognise the fundamental parts of a computer and their functions, distinguish types of software, analyse and compare computer configurations and use all this knowledge to choose the best computer for their needs	13–18	90	petlja.org/sr-Latn-RS/kurs/19635

This Handbook can be used by Informatics teachers as a complementary resource on relevant psychological and pedagogical topics that can support the effective implementation of the lessons. It can also be used by pre-service and in-service teachers of any subject area, regardless of whether or not they use the four Co-CREATE lessons available on the online platform, as a guide to effective planning, delivery and evaluation of lessons that take into account students' different needs, motivations and learning styles.

The first part of the Handbook covers general topics relevant to teachers of all backgrounds and subject areas working in different educational contexts. These topics include multiple intelligences, learning styles, learning strategies, motivation for learning, classroom management, participation and inclusive education, lesson planning, teaching methods and evaluation. The last two chapters focus on the project's core themes: Computer-Supported Collaborative Learning (*Computer-Supported Collaborative Learning*, CSCL), including the digital tools that can facilitate it, and the responsible use of artificial intelligence (AI) in education.

In each chapter, we have included green text boxes with examples of how the Co-CREATE lessons apply specific pedagogical and psychological concepts. By following the links provided,

readers can access the relevant sections of the online lessons and better understand the theoretical concepts presented in the Handbook.

In addition to this Handbook, practical guidance for teachers has been integrated into the e-learning platform. Through the Petlja AI assistant, teachers can receive support in planning and organising lessons on any topic available on the platform, adapting them to students' motivation and abilities and more effectively achieving both subject-specific learning outcomes and goals related to students' social development.

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Multiple intelligences

MULTIPLE INTELLIGENCES

LEARNING OUTCOMES

The teacher will be able to:

- explain the theoretical framework of the theory of multiple intelligences
- distinguish and explain, in their own words, the types of intelligence according to Gardner's theory
- identify the important factors that influence intelligence
- apply the theory of multiple intelligences in teaching in a way that recognises the individual differences of their students

KEY CONCEPTS

- Gardner's theory of intelligence
- Logical-mathematical intelligence
- Linguistic intelligence
- Visual-spatial intelligence
- Bodily-kinesthetic intelligence
- Musical intelligence
- Interpersonal intelligence
- Intrapersonal intelligence

INTRODUCTION

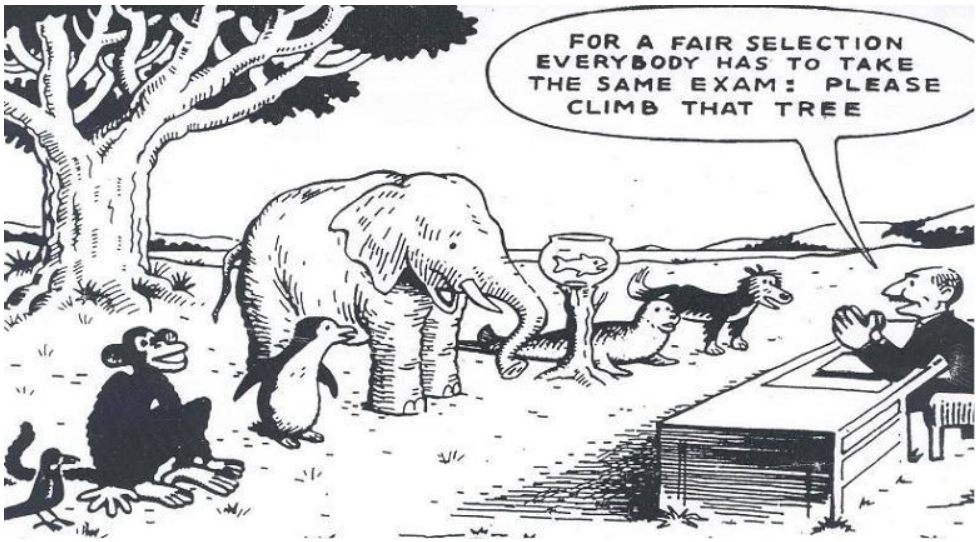


Figure 1. Diversity of abilities Source: https://understandingtheprimarylearner.weebly.com/gardner.html

„Everybody is a genius. But if you judge a fish by its ability to climb a tree, it will live its whole life believing that it is stupid." — Albert Einstein

Questions for reflection:

Is this situation fair? Why?

Which skills are valued in our school?

What about students who succeed in other domains? Are they less valued at school?

It seems that our education system mainly values linguistic and logical-mathematical abilities. However, many people have succeeded in other domains. Some of them are Judith Butler, Wolfgang Amadeus Mozart, Aretha Franklin, Michael Jordan, Svetlana Zakharova, Meryl Streep, Sigmund Freud, Luciano Pavarotti and Michael Jackson. They are all proof that human intelligence is much more complex and diverse than it may seem.

INTELLIGENCE – WHAT IS IT?

People hold implicit theories about what intelligence is, and many throughout history have tried to uncover what lies at its core. Lay ideas about intelligence are shaped by personal experience and general knowledge, and vary from culture to culture, which shows that there is no single way of thinking about this human trait. What is most often associated with intelligence is the capacity for abstract thinking, the ability to adapt to the environment and the ability to learn.

One of the most influential theories of intelligence held that *intelligence is a single general ability* that enables people to think, solve problems, organise information and plan events. The idea of the G factor (general ability) and the S factor (specific abilities) was developed by **Spearman**. According to this theory, a person can take several intelligence tests and obtain results that are fairly consistent with one another – which is explained by the G factor – while the differences between results are explained by the specific abilities that each test requires.

Questions for reflection:

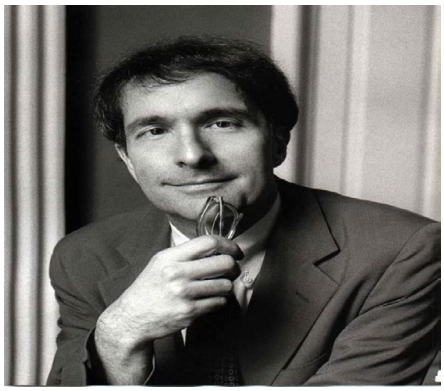
Think about the advantages and disadvantages of defining intelligence as a single ability, represented by the G factor. Why is it important that there are alternative perspectives on intelligence, particularly in education?

Imagine that two students in your class have the same overall score on an intelligence test and think about the ways in which they may nevertheless differ significantly.

Some researchers challenged this theory, postulating the existence of multiple factors of intelligence, as in Cattell's theory of fluid and crystallised intelligence. However, one theory

stood out from the rest, as it *views intelligence as a set of mutually independent intelligences* – Howard Gardner's theory of **Multiple Intelligences**.

GARDNER'S THEORY OF MULTIPLE INTELLIGENCES



Source: historica.fandom.com/ wiki/ Howard_Gardner

Moving away from the view of intelligence as a single trait, Gardner defines intelligence as the ability to solve problems or to create products that are valued in a particular culture or community. Gardner's intention was not to explain intelligence test results and why they correlate to some extent, but rather to explain the different roles people take on throughout their lives. According to this theory, each person has a *unique combination* of different intelligences – logical-mathematical, linguistic, visual-spatial, bodily-kinesthetic, musical, interpersonal and intrapersonal – and these intelligences are *developed to different degrees*, which makes each person unique.

Table 1. Gardner's intelligences and a description of people with particular, markedly developed intelligences

Intelligence	**Description of the people**	**Roles of these people**
Logical-mathematical	Naturally and spontaneously organises things in a particular order Easily handles quantities from memory Quickly understands mathematical concepts Enjoys computers, logic games and puzzles	mathematicians programmers accountants scientists
Linguistic	Enjoys reading, writing, listening and speaking Has a talent for telling stories or recounting events Has a strong memory for verbal information Enjoys expanding vocabulary and learning foreign languages	poets journalists copywriters lawyers
Visual-spatial	Easily perceives symmetry and harmony and is able to mentally rotate complex objects and draw them Finds their way easily in streets they are visiting for the first time Is good at puzzles	geographers surgeons painters pilots

Intelligence	Description of the people	Roles of these people
Bodily-kinesthetic	Handles objects well and moves their body gracefully and with ease Succeeds in physical exercise Stands out for the skill and dexterity that allow them to create objects successfully	dancers mountaineers gymnasts basketball players
Musical	Easily detects tempo, rhythm and patterns in things that do not seem to have them at first sight Enjoys various musical genres and plays an instrument, either by ear or through formal knowledge	composers conductors sound engineers singers
Interpersonal	Easily understands the feelings and moods of others Is a natural leader and is often well liked in the group Skilfully mediates interpersonal conflicts, because they can see a situation from two perspectives	psychologist teacher social worker politician manager
Intrapersonal	Knows themselves very well Is aware of their feelings, ideas, needs and dreams Persistence and determination are defining traits, especially in activities they enjoy	philosopher psychotherapist writer artist

As Table 1 shows, certain roles are predominantly associated with a specific intelligence; however, this does not mean that the other intelligences are entirely undeveloped in that person. If we think of a professional dancer or choreographer, that person certainly has a highly developed bodily-kinesthetic intelligence, but at the same time also needs musical intelligence to recognise the rhythm of the music and synchronise their movements with it.

Questions for reflection:

Think about Gardner's intelligences and try to identify some of them in your students. As you read on, think about how you could use your knowledge of the different intelligences to adapt your teaching.

The importance of Gardner's theory of multiple intelligences:

- The measurement of intelligence has traditionally been linked to the school context, which favours linguistic and logical-mathematical skills, as well as the "paper and pencil" assessment method – Gardner's theory reminds us that there are many abilities that count as intelligence but are under-represented in

education, and calls for the *recognition of these differences* (you can read more about this topic in the chapter on Inclusive Education).

- For example: students can be given different ways of demonstrating what they know – oral answers (linguistic intelligence), mind maps (visual-spatial intelligence) or organising a simulation or performance (bodily-kinesthetic intelligence).

- It promotes *interdisciplinarity and creativity in teaching* – teaching can be personalised according to students' dominant abilities, making it easier for them to learn the content.

  - Interdisciplinarity can be linked to outdoor or field-based learning; for example, knowledge of History can easily be related to art, music or language study during a visit to a monastery or museum, so that, after the visit, students can be asked to find examples of musical, artistic or literary works related to a particular historical period.

  - Sometimes lessons can also be adapted and delivered creatively: depending on the topic, you can use short videos or films, present certain information schematically, start discussions, create demonstrations through engaging activities or simply show certain instruments so that students can see or use them.

- It calls for *practice in the community or in the field* – certain knowledge can be transferred to the field or to the community, allowing students to connect knowledge from various areas or even try out certain aspects of an activity.
  - For example: foreign language lessons can be moved to institutes where that language is taught, where students can practise their language skills through direct communication (linguistic intelligence); in Sociology lessons, students learn about the constitution, rights and the democratic system, so an organised visit to the municipal assembly or a court could allow them to simulate and "experience" what it is like to make decisions about changes to laws and similar topics (interpersonal intelligence); Biology lessons can be organised as a practical activity, such as cleaning up the school playground (bodily-kinesthetic intelligence), through which students develop an awareness of ecosystem preservation, or through creating a map with the plant species marked in their neighbourhood (visual-spatial intelligence).

- Intelligences are *strongly influenced by the environment*, that is, by the culture that favours certain ways of thinking, learning and acting, which implies that *intelligences develop*. You can read more about the influence of environment and heredity on intelligence later in this chapter.

CSCL promotes both the acquisition of content knowledge and the development of transversal skills (*soft skills*). Teachers can design tasks that require different types of intelligence to be solved and create heterogeneous groups in which team members complement each other. For example, in the Co-CREATE lesson on cryptography, we suggest organising a debate on levels of privacy protection, to which students with linguistic and interpersonal intelligences can contribute. The subsequent encryption and decryption activities may be better suited to students with highly developed logical-mathematical intelligence. It is not possible to cover all intelligences in a single lesson, but teachers should always try to organise diverse types of activities and tasks and to connect their lessons with other subjects, as suggested in the Co-CREATE lesson on cryptography (History) and in the lesson on pivot tables and charts (Physical Education and Biology).

In Appendix 1 you will find an example of how to adapt a lesson to students' different intelligences, i.e. their different learning styles.

HEREDITY AND INTELLIGENCE

The question of the influence of heredity and environment on intelligence has been debated many times. Some scientists consider heredity to be more significant, while others insist on the decisive influence of the environment. Most scientists today take a more moderate position – **both factors influence intelligence**, which is supported by numerous studies of identical and fraternal twins, as well as of adopted children. The results of these studies show that the highest correlations in intelligence are found among the closest relatives who share the same living environment, namely identical twins raised together. As the degree of kinship becomes more distant and environmental conditions differ, the correlations decrease.

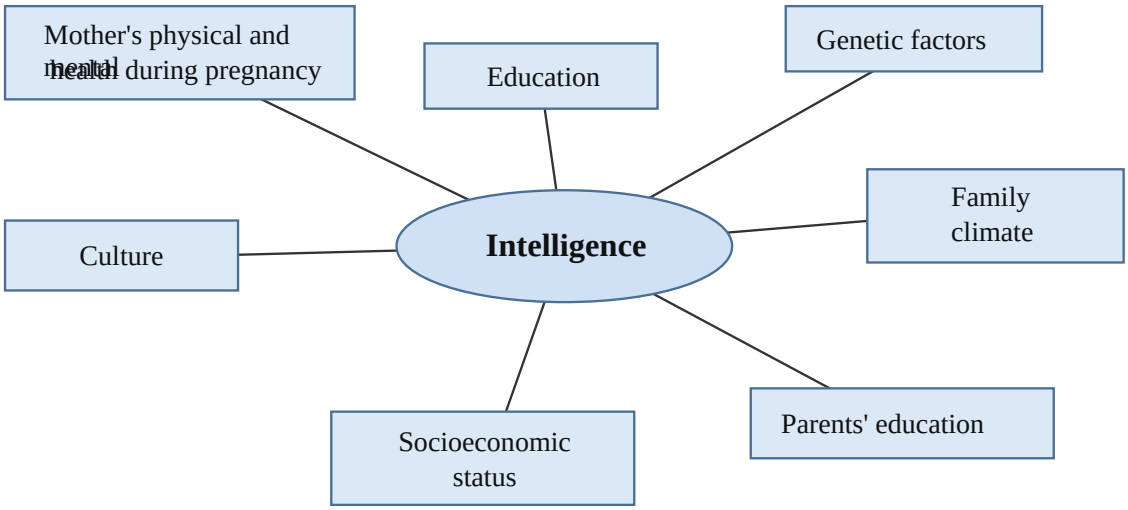


Figure 2. Factors influencing intelligence

Furthermore, research shows that intelligence differs when children of different socioeconomic status are assessed. There are correlations, albeit moderate, between a child's intelligence and the father's occupational status. The average intelligence quotient of children from rural areas is consistently lower than the average of children from urban areas. In addition to all these data, it is important to take into account other factors that affect the final result – namely, the state of the person taking the test: whether a child is anxious, sleep-deprived, has a psychological problem or is even motivated and ready to work will influence the results of an intelligence test, just as it would affect the results of a test or a written assignment. All these findings show that the influence of the environment on the development of children's intellectual abilities is strong.

Questions for reflection:

Intelligence test results of children from the Roma population show that their scores are lower than those of children from the general population. Think about what might explain these results.

Key points:

- Genetic factors influence intelligence and thus prevent unlimited development of intellectual abilities.
- Intelligence is also influenced by the environment (schooling, socioeconomic status; adequate stimulation from the environment increases the intelligence quotient).
- Beliefs about whether intelligence can change affect our intelligence: if a teacher believes that intelligence can be changed under the right conditions, they will create a stimulating environment that can contribute to students' intellectual development. The opposite situation, in which a teacher believes that intelligence is a result of heredity, means they will not even try to create a stimulating environment for the children – which poses a particular risk for children who do not have an enriching environment at home. You can read more about this topic in the chapter Student motivation and engagement.

- School has a significant influence on intelligence and on the development of children's intellectual abilities. Research conducted by Ceci (Vizek, p. 90) shows that there is an increase in the intelligence quotient during schooling, which can be explained by the positive effect of education on the ability to memorise, perceive, classify and use language.

PRACTICAL APPLICATION – RECOMMENDATIONS FOR TEACHERS

As already mentioned, Gardner's theory is very important for education, because it makes it possible to enrich teaching, present certain facts or practices in different ways and raise awareness that different abilities do not imply lower intelligence, but rather a diversity that should be respected. Our behaviours are closely linked

to the conceptions we hold about intelligence, so our approach to a child will vary depending on how we think about intelligence, but also on how we assess that child's intelligence. You can read more about the Golem effect in the chapter on Inclusive Education.

According to Gardner's theory, a specific (dominant) intelligence develops in children very early, which means that stronger or weaker abilities can be identified relatively early. The task of teachers at this age is to recognise the more developed types of intelligence and support the development of the less developed ones, through specific tasks and activities. In this way, the child's interests are followed and they are given the opportunity to develop their potential and self-confidence. An example of this practice would be a girl called Dunja, who loves chatting, reading books and drawing, but struggles with games such as tag and has no interest in mathematics. If Dunja's teacher notices her strengths (linguistic and visual-spatial intelligence) and her weaknesses (bodily-kinesthetic and logical-mathematical intelligences), she will assign her tasks in which Dunja can use her stronger skills and receive praise and encouragement to try tasks that require mathematical and kinesthetic abilities.

In addition to all of the above, in the chapter on Learning styles you can read more about the practical use of Gardner's theory and how you can incorporate it into your own teaching.

QUESTIONS FOR REFLECTION

1. In your teaching, do you offer students different ways of demonstrating their knowledge? Give concrete examples and think of other ways of putting this into practice.
2. How do you adapt your teaching to students with different abilities and interests?
3. Do you use learning outside the classroom, and how often? What encourages you to do so, and what holds you back?
4. What could you change in your teaching, starting next week, to support the development of different intelligences in your students?

CONCLUSION

In this chapter, we explained Gardner's theory of intelligence and highlighted the importance of recognising these abilities, as well as the importance of encouraging the development of those that are less developed. In particular, we highlighted some guidelines for teaching: differences should be accepted; interdisciplinarity should be pursued, allowing students to master the content more effectively; diverse teaching methods that respect the different intelligences should be used; there should be greater engagement with the content through practice or community activities; our conceptions of intelligence affect students' behaviour; and the environment, especially the school environment, has a certain influence on intelligence. Although the concept of intelligence is very complex, the focus

has been on how Gardner's theory can be used to improve teaching and to adapt it to students' specific characteristics.

REFERENCES AND LINKS FOR FURTHER READING

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2. Macura, S. (2015). *Inclusive Education: Quality Education for All*. Faculty of Education, University of Kragujevac.
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4. Zarevski, P. (2000). *Structure and Nature of Intelligence*. Jastrebarsko: Naklada Slap.
5. Gardner, H., Kornhaber, M. L., & Wake, W. K. (1999). *Intelligence: Multiple Perspectives*. Naklada Slap.

Resources for further learning:

1. https://youtu.be/iYgO8jZTFuQ?si=lea_-kJ-daSBmPBd
2. https://youtu.be/IYh8yoQJJSk?si=tyMNTYg-wTYskUNo

Learning styles

LEARNING STYLES

LEARNING OUTCOMES

The teacher will be able to:

- Explain the concept of learning styles and its relevance to differentiated instruction.
- Name and describe the seven learning styles according to the theory of multiple intelligences and the four learning styles according to Kolb's theory.
- Identify students' dominant learning styles through observation, conversation and active engagement.
- Plan teaching activities and adapt teaching methods and forms of work according to students' different learning styles.
- Create differentiated tasks that allow students to demonstrate knowledge in various ways.
- Evaluate the effectiveness of the strategies applied and reflect on their own practice in order to improve teaching.

KEY CONCEPTS

Seven learning styles:

- Linguistic
- Logical-mathematical
- Visual-spatial
- Bodily-kinesthetic
- Musical
- Interpersonal
- Intrapersonal

Differentiated instruction

Experiential learning

- Learning cycle:
  - experiencing
  - reflecting
  - thinking
  - applying

Kolb's learning styles:

- diverging
- assimilating
- converging
- accommodating

INTRODUCTION

At the end of the lesson, the teacher, Ana, was very pleased — she had explained the material clearly, written the key concepts on the board, illustrated them with examples and finished with a few questions. Several students raised their hands and answered correctly. The others nodded. However, as the students were leaving the room, she overheard some passing comments. "If only we'd discussed this a bit. I would have understood it better," said Ivan. Sara added: "I would have drawn it. This way, it doesn't seem clear to me." "We could have made a model or done an experiment," said Pedro thoughtfully. Una smiled: "If this were a song, I would have remembered it straight away." Luka simply said: "It was fine for me."

Ana was left thinking. If the lesson had been "good", why hadn't it been good for everyone? The next day, she decided to try something different. Instead of a single approach, she prepared several activities. The students worked in groups: some made mind maps, others solved exercises, others debated, others wrote short reflections. Some created a rhythm to connect the key concepts, while others prepared a short practical demonstration of the material.

Ana was sure that, this time, the atmosphere had been different. She again paid attention to the comments as the students left. And indeed, the lesson had reached everyone — Una was humming the rhythm she had created in class, Ivan was still animatedly discussing the topic with several classmates, Sara was happily pinning to the wall the drawing she had made about the material…

Ana realised that the problem had not been the students' motivation, but the fact that the same content does not reach everyone in the same way.

Questions for reflection:

Is a lesson truly successful if it is only successful for some students?

Do all students learn in the same way — or do we simply teach in the way that comes most naturally to us?

What changes in the classroom when we change the approach rather than the content?

DIFFERENTIATED INSTRUCTION — A LESSON TAILORED TO EACH STUDENT

Understanding and applying the concept of learning styles has multiple implications for teacher effectiveness and student satisfaction. **Differentiated instruction** is a teaching approach that seeks to respond to the different learning needs and preferences of students in the same classroom (Alabi, 2024). In practice, this means that the teacher will modify, or **adapt, teaching methods and assessment strategies** to each student's learning style, as well as to other characteristics (for example, motivation or a specific disability – you can read about this in the chapters on motivation and inclusion). This creates a positive classroom environment that will promote a deeper understanding of the content, as well as student engagement and the development of their authentic skills.

Questions for reflection:

Do you already use any methods of differentiated instruction? Which ones?

LEARNING STYLES — NOT UNDERSTANDING THE LESSON, OR UNDERSTANDING IT IN DIFFERENT WAYS?

Learning styles refer to the preferred ways in which each person processes, retains and applies information during the learning process (Alabi, 2024). They do not arise on their own; rather, they are the product of the interaction of various cognitive, emotional and environmental factors that shape individual differences in how people approach learning and understanding content. There is therefore no single "correct" style — different approaches work and feel natural for different people.

Although there are numerous conceptualisations of learning styles, in this chapter we will present the learning styles that derive from Howard Gardner's theory of multiple intelligences (you can read more about this theory in the previous chapter) and David Kolb's experiential theory.

There are thus **seven learning styles**: linguistic, logical-mathematical, visual-spatial, bodily-kinesthetic, musical, interpersonal and intrapersonal. Each will be addressed individually in the following sections.

Practical application of the seven learning styles



Diagram 1. Learning styles *[AI-generated, adapted]*

Linguistic style

Students who prefer this style learn best through language, speaking, reading and writing — that is, through the use of words and verbal expression. They understand and retain the material more easily when they can explain, retell, discuss or write it in their own words.

- Encourage students to **take notes in their own way** during the lesson.
- Explain the material **through a "story"** — connect the concepts in a logical sequence — for example: instead of a dry list of facts, introduce the topic through *a situation or problem*, then explain what is happening and why and, finally, draw a conclusion.

- Organise **debates** among students during the lesson, asking questions such as *"What would you do in this character's place?"* or *"Which cause is more important and why?"*, or start a *for-and-against* debate on specific topics.
- Set **activities** that include **reading** excerpts from books, interesting texts from the internet and magazines (make the effort to bring these materials to class and recommend where students can read and explore on their own), as well as **writing** — ask them to write **opinion pieces**, do reviews or prepare short presentations that they will deliver and explain themselves.

- At the end of the lesson, ask them to write briefly what they have learned — to **create their own summary** and formulate questions about anything that was unclear or that they would like to explore further.

Logical-mathematical style

Students who prefer this style learn best through logic, patterns, analysis and problem solving, as they like to understand how things work and to arrive at solutions step by step. They are most successful when they have the opportunity to organise information, identify relationships between concepts and explain their reasoning.

- Start the lesson with an interesting **challenge** or **puzzle** — this will quickly draw them into the topic and the rest of the lesson and will activate the thinking style that suits them best.
- Set **problem-based tasks** and present them as small logical challenges — ask students to "untangle" the problem step by step, connect information and discover patterns. Encourage them to explain **how they arrived at the solution**, and not just what the solution is, as this further develops their analytical thinking and understanding.

- During lessons, use as many **diagrams**, **charts** and **statistical representations** as possible, as they present the material clearly and accessibly; visually highlight logical conclusions, underline the connections underlying a broader system and bring out cause-and-effect relationships.
- For homework, ask students to **organise the material themselves** — they can create a table, draw a diagram and connect concepts, highlight some important logical relationships they have identified and explain the steps or process by which they reached their conclusions.

Visual-spatial style

Students who prefer this style learn best through images, diagrams, colours and spatial relationships, as they understand and retain information more easily when they can "see" it in an organised visual form.

- Structure content visually, as this helps students **"see" the relationships** between pieces of information: use **mind maps**, **concept maps** and **charts**; highlight **key concepts** with colours; **organise the board** clearly — with headings, subheadings and a hierarchy of information; **connect concepts** with arrows and symbols.
- Use **images and spatial representations**, as images help make abstract concepts concrete.
- Encourage students to **create their own visual representations** (sketches next to their notes, posters or visual summaries of the material, symbolic representations of key concepts, etc.), as this deepens understanding.

- Connect speech with visual presentation, as this improves clarity and helps retain information: while explaining, **write or draw at the same time**; present the structure of the lesson with a visual outline; use gestures to emphasise relationships and directions.

Bodily-kinesthetic style

Students who prefer this style learn best through movement, hands-on work and direct experience, as they absorb information more easily when they can physically "live" it and handle it. They are most successful when learning involves activities such as experiments, model building, role-plays and tasks that require movement and active physical participation.

- Integrate **hands-on activities** into your work as early as possible. Use physical objects, models and materials — even simple things like cards or puzzles, drawing on large sheets of flip-chart paper with thick markers, etc. — what matters is that students can **touch**, **handle and experiment**.
- Encourage them to relate the material to **bodily sensations**. Guide them to imagine and describe how something would "feel" in a real situation. In this context, you can also organise **role-plays (*role-play*)** — ask them to simulate situations and "act out" the processes, characters and principles they are studying.
- ***Throw them in at the deep end*** — give them tasks in which they assemble and disassemble simple models and mechanisms and carry out mini-experiments. Let them explore, experiment and discover for themselves how things work.
- Integrate physical movement into the learning process — use **educational games that involve movement**. For example: 1) *True/False* — students physically move to one side of the room or the other, depending on their answer; 2) *Matching concepts in space* — give students slips of paper with different parts of concepts, definitions or examples. Their task is to move around the room and find the classmates with whom they form a complete group — so that all the parts together form a whole or a logically related category.

Musical style

Students who prefer this style learn best through sound, rhythm and melody, as they find it easier to memorise information when it is associated with auditory patterns. They thrive particularly when the material is turned into rhymes, songs or rhythmic structures, or when listening to audio materials and sound stimuli is integrated into the learning process.

- When creating mnemonics or acronyms to help memorisation, create them together with the students, so that they become **rhymes**, invent a **melody or rhythm for memorising** and link them to a well-known song. Encourage students to create their own versions.

- As these students will always remember something they heard better than something they read, recommend **audiobooks** and **educational podcasts** they can listen to; occasionally, you can also play excerpts in class.
- For practical skills, use **audio recordings** of real events related to the topic, to make visualisation easier (for example, sounds of natural phenomena, machine sounds, sounds of a city and of people in particular situations, etc.).
- Encourage them to **record their own voice** while studying and listen to these recordings later — this will improve retention and memorisation.

Interpersonal style

Students who prefer this style learn best through collaboration, communication and exchanging ideas with others, as they acquire knowledge more easily when interacting with classmates. They thrive above all in group activities, debates, peer learning and situations in which they can explain, listen and solve problems together.

- Organise **peer mentoring** — divide students into groups and have each group become "experts" in one area of the material. Then form random pairs so that they can pass on knowledge to each other through conversation and learn from one another.

- You can also organise active peer learning as follows: first, give students time to think about the topic individually; then ask them to discuss it in pairs; finally, have them share and discuss it at whole-class level.
- Divide them into groups and give each group a **problem-based task** — encourage them to exchange ideas, give each other constructive criticism and praise, discuss and share their notes and observations with the group; you can also give everyone the same task and organise a small competition or knowledge quiz.
- Here too you can use **role-play (*role-play*)** as a teaching method — in pairs or small groups, assign students specific roles related to the lesson topic (for example, in a History lesson they could be military commanders, warriors, rulers or historical figures; in a Chemistry lesson, different chemical elements; in a Literature lesson, different characters…) and, after a while, ask them to swap roles and observe what changes.

Intrapersonal style

Students who prefer this style learn best through reflection, introspection and a personal connection with the material, as they absorb information more easily when they can relate it to their own experiences, thoughts and interests. They thrive

above all when they have the opportunity to learn at their own pace and to reflect on the content in silence.

- Encourage **independent learning** — these students learn best when they work independently. Give them time and space for individual work, in which they can clarify information they were unable to understand on their own.
- Make connections with **personal interests** — help students find a personal connection with the topic. Encourage them to ask questions such as: "What does this give me?", "Why is this important?" or "How can I apply this idea?". This will stimulate their intrinsic motivation and active reflection on the material.
- Encourage them to keep a **journal** or **notes** about their thoughts, feelings and experiences while learning — ask them to record challenges, solutions, doubts and what they found useful or difficult, as well as what sparked their interest.
- Encourage them to **visualise** processes, events or principles while learning. Ask them to mentally follow a procedure, skill or event, visualising it in their own way — integrating their thoughts and feelings about the situation and relating it to their own experiences and interests.

Questions for reflection:

To what extent do you recognise different learning styles in your students?

Which learning styles predominate in your teaching approach? Do you unconsciously favour any of them?

Now think of a specific teaching unit and how you could adapt it to each of the learning styles mentioned above.

PRACTICAL APPLICATION OF EXPERIENTIAL THEORY AND THE FOUR LEARNING STYLES

David Kolb's Experiential Learning Theory (1984) proposes that learning is a continuous process in which knowledge is created through the transformation of experience. According to Kolb, effective learning occurs when learners move through a cycle of experiencing, reflecting, thinking and acting. Kolb identified four stages of learning:

- **Concrete Experience (Experiencing)** – The learner encounters a new experience or actively takes part in a situation (carrying out an experiment, taking part in a role-play, observing a demonstration).
- **Reflective Observation (Reflecting)** – The learner thinks about the experience, examines what happened and considers different perspectives (class discussions, learning journals, reflection questions).

- **Abstract Conceptualisation (Thinking)** – The learner develops concepts, theories or general principles based on reflection (studying models, identifying patterns, formulating explanations).
- **Active Experimentation (Applying)** – The learner tests ideas in new situations and applies what they have learned (projects, problem-solving activities, practical applications).

Learning activities should engage students in multiple ways. Teachers can support learning by:

- Providing authentic experiences connected to students' lives.
- Encouraging reflection through discussion and self-assessment.
- Helping students develop concepts and generalisations.
- Offering opportunities to apply knowledge in new contexts.

A lesson that includes experience, reflection, conceptual understanding and practical application is more likely to engage a diverse range of students and to promote deeper understanding.

Kolb suggested that people often develop preferences for certain parts of the learning cycle, which results in four learning styles[3] (Table 1).

Table 1. Kolb's learning styles

Learning style	**Characteristics**	**Preferred learning activities**
Diverging (Concrete experience + Reflective observation)	Imaginative and creative Able to see situations from multiple perspectives Interested in people and emotions	Debates Brainstorming Storytelling Reflection
Assimilating (Abstract conceptualisation + Reflective observation)	Analytical and logical Interested in theories and concepts Prefers structured information	Lectures Reading Models and theoretical frameworks Research tasks
Converging (Abstract conceptualisation + Active experimentation)	Practical and solution-oriented Enjoys applying ideas to solve problems Focuses on technical tasks	Problem solving Simulations Investigations Design challenges

Learning style	Characteristics	Preferred learning activities
Accommodating (Concrete experience + Active experimentation)	Action-oriented Learns through experience Comfortable taking risks and trying new approaches	Projects Role-play Fieldwork Practical tasks

Although problems in STEM subjects often require converging or assimilating learning styles and logical-mathematical intelligence, complex real-world problems are best solved by diverse teams that bring together different perspectives, strengths and skills. In our Co-CREATE lessons we sought to engage students with different learning styles by proposing hands-on activities suited to students with an accommodating and bodily-kinesthetic style (as in the lesson on Computer assembly), debates and discussions suited to diverging, linguistic and interpersonal styles (as in the lesson on Cryptography), as well as mind maps, suited to visual-spatial styles (as in the lesson on Computer components).

In Appendix 1 you will find an example of how to adapt the lesson on Computer components to students' different learning styles.

CONCLUSION

Understanding learning styles in the light of the theory of multiple intelligences shows that students do not approach learning in the same way and that content can be experienced and acquired in various ways — through language, logic, images, movement, sound, social interaction or introspective reflection. In this sense, the teacher's fundamental role is not to find "the best way" to teach, but to **provide diverse approaches** that allow each student to experience learning in the way that suits them best. This is precisely the aim of differentiated instruction and of an approach that moves away from the traditional view of the acquisition and assessment of knowledge as essentially verbal-linguistic and logical-mathematical in nature.

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[3] Although Kolb's model remains influential in education and professional training, research has not consistently shown that matching teaching to a student's preferred learning style improves their performance. The model is more useful as a framework for designing varied and engaging learning experiences than for categorising students into fixed learning types.

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Relevant links:

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Learning strategies

LEARNING STRATEGIES

LEARNING OUTCOMES

The teacher will be able to:

- explain the concept of learning strategies and their importance
- name and describe various learning strategies
- evaluate the effectiveness of the strategies described
- apply teaching methods that support different learning strategies

KEY CONCEPTS

- content organisers
- mnemonics
- elaboration
- retrieval practice (*retrieval practice*)
- distributed learning
- spaced learning
- interleaved learning (*interleaving*)
- self-regulation
- metacognition

INTRODUCTION

Anja and Luka have to prepare for a History test in a week's time. Luka decided to start studying early, read the material several times and underline what he considers important. Anja, on the other hand, made a plan: read the material, underline the main points, take notes and regularly test herself, reviewing the material.

When the day of the test came, Anja left the room in a good mood, pleased with how it had gone. Luka, however, left a little disappointed. He felt he had not done his best on the test. He wondered what had gone wrong — he had started studying in time, had read the material several times and yet could not remember the answers to many questions.

Talking to Anja, he realised that they had both invested almost the same amount of time in preparing for the test. Still, Luka was left wondering: had he really been learning all that time, or did he simply have the impression that he was learning?

Questions for reflection:

How often do students in your lessons have the opportunity to learn "how to learn"?

In what ways do you encourage students to use effective learning strategies?

LEARNING STRATEGIES

Why do students sometimes have difficulty learning? The answer to this question is far from simple, but this chapter will address only one of the possible answers: because sometimes this is not due to the students themselves or to the material, but to the fact that no one has ever taught them *how to learn*.

One of the most important things, and one that is often neglected in the classroom, is the development and teaching of learning strategies. Effective learning strategies also answer the question raised in the introductory story: *why does investing more time in studying not always produce the results we expected?*

Learning strategies encompass all the behaviours and thought processes that enable more effective learning — that is, all the activities and actions that students use to facilitate the acquisition, storage or retrieval of information.

You have surely noticed that students differ in how they approach the content and material they study. This can depend on many factors: **personal** (such as learning styles, motivation and beliefs about themselves), **situational** (such as the form of assessment and the context) or **characteristics of the task itself** (such as its difficulty).

In a broader conceptualisation, we can group learning strategies into 3 main categories:

- **Deep processing strategy** — based on the student's genuine interest in the content they are studying; students seek to understand and learn the material as fully as possible through elaboration, critical thinking, additional research and similar methods.

- **Surface processing strategy** — based on seeing learning as a means to an end (for example, a grade); students tend to memorise mechanically rather than process information in depth.
- **Self-handicapping strategy (*self-handicapping*)** — based on a form of self-sabotage, in which students avoid making an effort so that, in case of failure, it can be attributed to a lack of effort rather than a lack of ability.

Questions for reflection:

How do you organise the teaching of lessons and assess your students' knowledge?

In your practice, do you actively promote deep processing strategies?

Research shows that the use of **deep processing strategies** is more likely to lead to conceptual understanding and longer-lasting retention of content, while the use of surface processing strategies is more likely to lead to lower-quality learning outcomes (Entwistle & Ramsden, 1983; Marton & Saljo, 1976a, b, cited in Lončarić, 2014).

Today we know of a large number of learning strategies. The following sections of this chapter briefly explain some of the best-known and most effective strategies, particularly relevant to deep processing of information. We will begin with some of the best-known and simplest.

Content organisers: notes, underlining, visual aids

As a teacher, you have probably noticed that some students come to class with notebooks and books marked in various ways — whether with underlining in pencil or highlighter, or with systematic notes and visual aids.

Organised material is easier to study and memorise. Organising content gives it structure, highlights what is most important and thus facilitates the learning process. Some of the best-known learning organisers are:

- **Underlining** — captures attention and highlights important information. **BUT:** it can be ineffective if students underline too much or do not properly select what is really important!
- **Notes** — taking notes captures students' attention and allows information to be kept in a single place, to which students can always return. **BUT:** it can be ineffective if students merely copy the material passively, without thinking about it!
- **Visual aids** — these strategies (for example, Venn diagrams, mind maps, timelines, charts) prove very effective and allow a better understanding of the material. **BUT:** they can be ineffective if presented in a disorganised way!

In the Co-CREATE lesson on the Structure of the computer system, we suggest the collaborative use of mind maps to bring out students' prior knowledge, organise it systematically and use it as a support tool in problem solving.

In the Co-CREATE lesson on cryptography, we showed how diagrams and schemes can help students understand new concepts. Building charts (for example, pie charts, bar charts and histograms in Excel) is at the heart of the Co-CREATE lesson on pivot tables and charts.

Mnemonics

Mnemonics are systematic procedures to facilitate the memorisation process. They are particularly useful when the material has little intrinsic meaning. There is now an enormous repertoire of mnemonic devices, some examples of which are presented below:

- **Method of loci (*method of loci*)** — involves associating the information to be memorised with a familiar place (for example, a classroom, a flat or a bedroom), which allows students to recall a particular concept whenever they think of or look at that place.

- **Acronyms** — a form of abbreviation that facilitates memorisation by joining the initial letters of concepts into a word (for example, if students have to remember how to set goals: SMART, because goals should be *Specific*, *Measurable*, *Achievable*, *Realistic*, *Time-bound*).

- **Acrostic** — involves forming a new meaningful word or sentence from the initial letters of the elements — for example, to learn the names of the oceans: **A**ll **A**nts **I**n **A** **P**ot (Atlantic, Antarctic, Indian, Arctic and Pacific).
- **Keyword method** — a very useful technique for learning vocabulary in a foreign language; it involves associating a foreign word with a similar-sounding keyword (for example, *le chat* (Fr. *cat*) can be associated with the word *chat*, and the student can imagine a cat having a chat).

Elaboration

Elaboration involves expanding existing knowledge with new information. It creates additional connections with existing information and is an example of a deep processing strategy. The more students elaborate on information, the more likely they are to deepen their knowledge and, consequently, the more effective and lasting their learning and memorisation will be.

For example, if students have to learn a new History topic about the First World War, they are more likely to learn it well if the teacher first explores what students already know about the topic and then teaches the material, relating it to that knowledge.

Questions about the topic can also be asked, or students' curiosity can be stimulated through discussion.

> In the Co-CREATE lesson on cryptography, we encouraged students to recap the most important knowledge from the lessons on loops and character strings (*strings*), so that they could learn about cryptography.

Retrieval strategy (*retrieval*)

Retrieval is one of the most effective learning strategies. It involves students testing their knowledge after studying the material, but without using study materials. Remember the example from the introductory story: Luka, who read the material over and over to prepare for the test, and Anja, who regularly tested herself and checked her knowledge. This way of learning helps students consolidate the material more effectively in long-term memory.

For example, it can be applied near the end of the lesson, with quizzes and knowledge-check questions after the material has been taught. These do not need to be graded — the aim is above all for them to be useful and engaging for students.

Distributed learning

Distributed learning is particularly effective for more lasting acquisition of material. It involves students dividing their study into smaller units spread over a greater number of days or weeks, instead of trying to learn everything in a short space of time (*massed practice*, also known as "cramming").

For example, you can divide a particular topic, which will be covered over a longer period, into several lessons, especially if it is more complex. You can also set homework on a single topic, divided into several tasks with different deadlines.

Interleaved learning

Interleaved learning (*interleaving*) is related to distributed learning and involves students studying different types of content within the same study block, rather than just one.

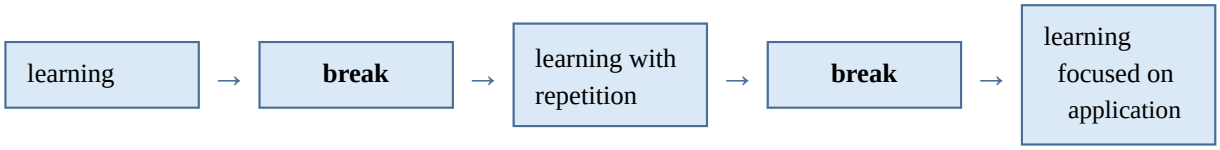
For example, instead of giving students exercises only on the grammar of a foreign language, it would be beneficial for them to spend 10 minutes on grammar, 10 minutes on vocabulary, 10 minutes on reading and then return to grammar. This allows students to return to tasks several times and consolidate the material more effectively.

Spaced learning

This strategy is based on a cycle of repetition and breaks within the same study session (Scheme 1). It is recommended that these breaks be guided in some way, so that students engage in another activity during this time. Students should not think

about the material — but about something completely different. This can help consolidate information in long-term memory.

Although this is not entirely feasible in 45-minute lessons, it is generally a useful strategy when students organise their own study.



Scheme 1. The logic of spaced learning

This strategy is very similar to distributed learning, but the main difference is that distributed learning applies to a longer period of time (days, weeks), whereas spaced learning applies to a single study session.

Self-regulated learning and metacognition: *when and why?*

All the strategies presented are part of a broader concept — the **self-regulated learning cycle**. **Self-regulation** involves directing and activating emotions, behaviours and thoughts to achieve a goal. **Self-regulated learning** can be defined as a self-directed process through which students transform their mental abilities into learning skills. A student who learns in a self-regulated way knows how to learn effectively. They will be intrinsically motivated, committed and will have both the skills and the will to learn. The main factors influencing self-regulation are:

- **Knowledge** — knowledge of oneself, one's learning styles, the possible strategies and the contexts in which knowledge can be applied.
- **Motivation** — interest in learning for its own sake.
- **Self-discipline** — "why am I learning?", protection against distractions and disruptive factors, perseverance.

Research shows that students with a greater capacity for self-regulation tend to achieve better learning outcomes. One study found that the capacity for self-regulated learning predicts academic success with 93% accuracy (Zimmerman, 1991, cited in Vizek Vidović et al., 2014).

According to Zimmerman's model, self-regulated learning takes place in three phases (Scheme 2):

- **Pre-learning phase** — creating the conditions for learning: goal setting and orientation, strategy planning, self-efficacy beliefs, intrinsic interest.

- **Learning phase** — maintaining attention, self-instruction and self-monitoring.
- **Post-learning phase** — self-evaluation, attributions, reactions and adjustment.



Scheme 2. Zimmerman's model

But what actually underlies self-regulated learning? It is **metacognition** — thinking about one's own thinking. It is precisely this that makes self-regulated learning possible through **planning, monitoring and evaluating one's own learning** (Scheme 3). Self-regulated learning and metacognition can also be promoted in the classroom, as will be seen in the following section.



Scheme 3. Metacognition

PRACTICAL APPLICATION — RECOMMENDATIONS FOR TEACHERS

How to teach students to learn?

- **Help students analyse tasks and set appropriate goals** — stress the importance of analysing tasks, clearly define expectations and help students learn to set realistic goals in their learning.
- **Model and explain different learning strategies** — teach various learning strategies, demonstrate where and how they can be used, talk with students and discuss the advantages and disadvantages of each strategy.
- **Give opportunities to practise learning strategies** — learning strategies are best learned through practice, which should come after you have explained them to students; also make a habit of giving feedback.
- **Promote students' sense of self-efficacy** — self-regulated learning is linked to a sense of personal competence, which you can nurture by valuing the learning process itself, setting sufficiently challenging tasks with support and highlighting students' progress.

- **Practise self-instruction aloud** — model thought processes by verbalising your flow of thought and your approach to solving different tasks and problems (for example, you can also ask students to think aloud while solving a task).

- **Encourage students to monitor and oversee their own learning** — encourage them to learn to assess the quality of their own work and to reflect actively on their learning (for example, by reviewing their homework independently).

In all Co-CREATE lessons we encouraged students to monitor their individual and group progress. Students can fill in Google Forms with self-assessment scales or write a short journal of their learning process.

CONCLUSION

Remember:

- Make an effort to talk more regularly with your students about the ways in which they learn.
- Teach your students learning strategies.
- Develop metacognition and self-regulated learning in your students.
- Cultivate deep information processing strategies, rather than focusing on surface processing and rote memorisation.

QUESTIONS FOR REFLECTION

1. Were you already familiar with any of the learning strategies described, or do you know whether your students use them?
2. Which of the learning strategies described interested you most and why? In what ways could you implement them in your teaching?
3. What would be the potential challenges associated with the learning strategies described?

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Student motivation and engagement

STUDENT MOTIVATION AND ENGAGEMENT

LEARNING OUTCOMES

The teacher will be able to:

- understand the concept of motivation and its role in learning
- identify factors that influence student motivation
- apply some of the strategies presented to motivate students
- reflect on their teaching practice and the ways in which it affects student engagement

KEY CONCEPTS

- motivation
- *mindset*
- needs
- emotions
- interests
- attributions
- self-efficacy
- autonomy
- expectations
- goals

INTRODUCTION

Teacher Maja enters the classroom. After writing up the lesson summary, she starts a Maths lesson on percentages. As usual, she begins by presenting the theory, followed by solving exercises from the workbook. She notices that only a few students are following, while part of the class is already losing attention, looking uninterested or absent-minded. Maja then pauses and thinks: "Maybe this isn't clear to them or isn't interesting enough… Or maybe they simply don't see what it's for."

She then turns to the students and asks: "What do you think – where are percentages used in real life? What do we even need percentages for?"

A brief silence follows, but the students' attention and engagement slowly begin to increase. One student raises his hand and says: "Well, for discounts, so I can buy my favourite Lego set cheaper!" This answer encourages the other students, who, laughing, gradually join in the lesson and give their own examples.

After this, teacher Maja decides to change the usual structure of the lesson, divides the students into groups and gives them a task: "Imagine you need to buy birthday presents for someone you like. Let's say: a Lego set, a book and an interesting board game, all with certain discounts. You have a limited budget and need to work out whether the money is enough."

The students are now actively exchanging ideas, debating and applying different problem-solving strategies, realising that maths is not just an abstract theory, but a tool that can help them in everyday life.

Questions for reflection:

In your opinion, what is the main problem at the start of Maja's lesson and why?

What do you think made the decisive difference to student engagement during Maja's lesson?

In what other ways could Maja engage and motivate her students? Give some examples.

STUDENT MOTIVATION AND ENGAGEMENT

Motivation is defined as an internal state that arouses, directs and sustains behaviour. In other words, motivation is the **driving force** that leads us to engage in an activity. It is one of the most important components influencing learning and engagement.

Stop and reflect:

Why are you reading this handbook – or this chapter on motivation – right now? What led you to take an interest in this topic?

There are currently a large number of theories and models of motivation. None is better than the others – they complement each other. The following section of this chapter presents only some of them, together with a summary of the most important factors for student motivation and engagement.

TYPES OF MOTIVATION: *"WHAT DRIVES STUDENTS?"*

Think back to some of your lessons. You have surely noticed that some students participate with curiosity and actively, are engaged and interested in the material you teach and find learning interesting in itself. On the other hand, there are students who tend to become more engaged when they hear the word *assessment* or just before a test or exam.

What can we learn from this example about types of motivation? In the first case, we are talking about **intrinsically motivated** students, that is, students who enjoy learning because the activity is rewarding in itself. The second example shows **extrinsically**

motivated students, who become more engaged because of external factors rather than learning *itself*.

In situations where students are rewarded for certain behaviours, we speak of **extrinsic means of motivation**. For these to be effective, it is important to consider the question: *what is important, or rewarding, for my students?* For example: being excused from a task, praise, a good grade and similar things.

On the other hand, there are also **internal, or intrinsic, aspects of motivation**, which are important for students' personal development (such as the need for autonomy, a sense of competence and self-esteem). These factors will be discussed in more detail later in this chapter.

Both types of motivation are important for students' success. It would be wonderful to see intrinsically motivated students, but it is not realistic to always expect this of them. Sometimes the use of rewards is necessary to motivate them and encourage them to learn further.

However, it is important to stress that student motivation depends not only on rewards and the content of teaching, but also on how students think about themselves, their goals and learning.

STUDENT MINDSET: *"WHETHER YOU THINK YOU CAN, OR YOU THINK YOU CAN'T – YOU'RE RIGHT"* (HENRY FORD)

Before moving on to specific factors of and approaches to motivation, one of the fundamental topics to mention is the concept of **mindset**. A mindset can be defined as the set of beliefs through which a person interprets events, challenges, successes and failures.

Carol Dweck, author of the book *"Mindset: The New Psychology of Success"*, highlights two types of mindset: **fixed** and **growth**. She argues that students' beliefs about whether their abilities can (or cannot) be changed can have a significant impact on their motivation and engagement (Scheme 1).

Growth mindset	Fixed mindset
"I can improve my skills" "Feedback is valuable" "Challenges help me grow" "Failure is an opportunity to learn"	"Either you're good at it or you're not" "Feedback is criticism" "I don't like being challenged" "Failure means I lack ability"

Scheme 1. Growth mindset and fixed mindset

As an example, let us return to the introductory story about teacher Maja and her Maths lesson. Imagine that in this class there is a student who is having difficulties with this material. He may

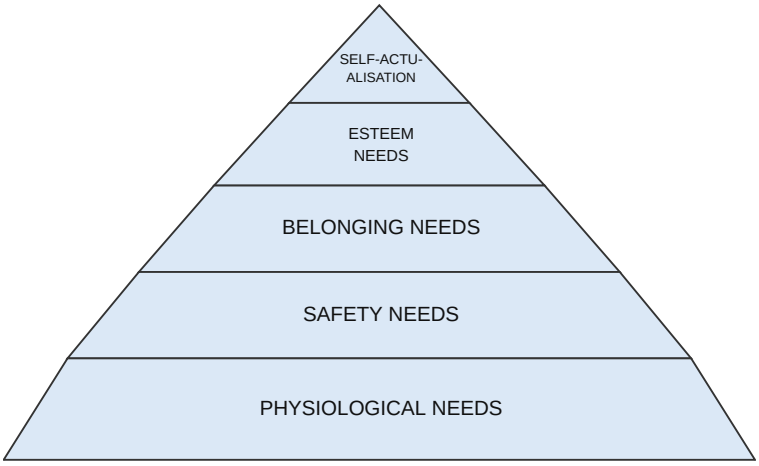
think that he is not capable enough to master it or that maths is simply not for him, which could lead him to give up completely (*fixed mindset*). However, he can also see the situation differently: as a challenge, but a challenge that can be overcome. The student can try to approach the problem differently, use different learning strategies or ask the teacher for help. In other words, he will not give up, but will try to change his approach (*growth mindset*).

MOTIVATIONAL FACTORS

1. Students' needs

Self-actualisation: "What a man can be, he must be"

One of the best-known humanistic psychologists, Abraham Maslow, presents a hierarchy of needs in his theory. He argues that in order to satisfy higher needs – or "growth needs" – the hierarchically lower needs, the "deficiency needs", must first be met. At the top of the hierarchy is **self-actualisation** – a person's capacity to fulfil their potential.



Scheme 2. Maslow's hierarchy of needs

Why is it important for motivation?

- **it allows us to see the student as a whole, with all their physiological, emotional and intellectual needs**
- **it makes it possible to create an environment, or conditions, that are aligned with the student's needs and can promote learning** – for example, we can ask ourselves whether we can really expect a student who feels threatened and unwelcome at school to be focused on the lesson.

Self-determination: autonomy, competence, relatedness

Why is it important?

It has been shown that classrooms that promote self-determination see greater student engagement and interest, through:

- **promoting autonomy** – students who feel they have greater freedom of choice and autonomy will be more readily motivated to engage than students exposed to restrictive conditions;
- **responsiveness** – a supportive environment and a sense of connection in the classroom have an encouraging effect on student engagement;
- **reinforcing competence** – students who perceive themselves as self-efficacious will be more likely to make an effort, will have more confidence and will take on challenges.

In the Co-CREATE lesson on pivot tables and charts, students can exercise autonomy by freely choosing the topic on which they collect data (our example focuses on healthy habits, but students can also collect data on the attitudes of the local population, municipal spending or analyse census data, for example). They can experience relatedness through group work in collecting, analysing and presenting the data. By learning new content, such as pivot tables, they develop a sense of competence.

2. Emotions and interests

Learning is strongly influenced by **emotions** and **interests**. If students experience learning as monotonous and uninteresting, they are unlikely to engage and become motivated.

However, if a situation stirs emotions in them (for example, surprise or amazement) and, at the same time, meets and sustains their interests, students are more likely to engage. Let us return once more to the introductory story about teacher Maja. A small change was enough to increase students' attention – stimulating curiosity with a question.

How do emotions and interests affect motivation and learning?

Interests and emotions can promote student motivation through:

- **directing attention**
- **associating pleasant experiences with learning**

3. Beliefs about success and one's own competence

Attributions: "I would have got a better mark on the test if I had made more effort…"

A question we all know, related to motivation, is: *"Why did I succeed or fail?"* We often tend to attribute the causes of events to our effort, our mood, our knowledge or even to luck, the clarity of the instructions or unfair conditions. According to psychologist Bernard Weiner, students attribute their

successes or failures based on three dimensions: **stability** (stable/unstable cause), **controllability** (within my control/outside my control) and **locus of causality** (internal/ external).

Table 1. Dimensions of success and failure

	INTERNAL		**EXTERNAL**	
	STABLE	**UNSTABLE**	**STABLE**	**UNSTABLE**
CONTROLLABLE	consistent effort	occasional effort	constant help or interference from others	occasional help or interference from others
UNCONTROLLABLE	ability	tiredness, mood	task difficulty	luck

How should this theory be interpreted and what is its role in motivation?

Attributions affect motivation through:

- **forming expectations of success** – students who attribute success to stable causes (for example, their knowledge) will be more inclined to expect to succeed again than students who attribute it to unstable causes (for example, luck);
- **emotions** – students who attribute their successes to internal factors (for example, effort) will more readily feel satisfaction and pride than students who attribute them to an external factor (for example, the ease of the task);
- **behaviour and effort** – students who believe they have control over the situation will be more inclined to engage than students with a lower sense of control.

Stop and reflect:

How do you interpret your students' successes and failures?

How might this, in turn, affect the interpretations they themselves make of success?

Teachers' expectations can influence students' behaviour and engagement. Teachers who have high expectations of their students can promote their self-efficacy and greater engagement, while negative expectations can lead to the opposite effects. This phenomenon is known as the "Pygmalion effect", and you can find more information about it in the chapter on Inclusive Education.

Self-efficacy: "This material is challenging, but within my reach"

When talking about motivation in the context of students' beliefs, it is essential to mention the concept of **self-efficacy**. Self-efficacy refers to **beliefs about one's own competence**. The concept

of self-efficacy is closely linked to the attributions discussed in the previous section – high self-efficacy implies attributing success to internal and stable factors, such as effort and knowledge.

What is the relationship between self-efficacy and motivation?

Greater self-efficacy leads to greater motivation through:

- **greater investment of effort** – students who believe they are competent are more likely to make an effort and invest energy in mastering tasks and challenges;
- **goal setting** – students who believe in their own competence are more likely to set higher goals and strive to achieve them.

4. Goals, expectations and values

Goal setting and goal orientations: "Today I'm going to get through these 100 pages!"

Goals are outcomes we seek to achieve. Based on experience, it is clear that goals influence our actions. However, it is essential that these goals are:

- **short-term**
- **measurable**
- **specific**

Example of a poorly defined goal:

"I'm going to improve all my grades!"

Example of a well-defined goal:

"By the end of the week, I will study 5 pages a day to improve my Maths grade."

Goal setting is one of the key components of self-regulated learning, discussed in the chapter on learning strategies.

When we talk about goals, we can distinguish between **performance goals and mastery goals**. These goal orientations are important because they represent patterns of beliefs that influence students' future engagement and success.

For example, when you notice students who keep trying, learning and practising regardless of how many mistakes they make along the way, these are students with a **mastery goal orientation**, whose essence is improvement and the learning process itself. These students are more likely to ask for help, use various learning strategies and have more self-confidence. On the other hand, students who set themselves **performance goals** are more concerned with "showing off or being better than others". These attitudes can be harmful to students and to the beliefs they hold about themselves.

Why are goals important for motivation?

Goals motivate students to engage by:

- **directing attention to the task**
- **encouraging effort**
- **increasing persistence**

Expectations and values: "I can do it… but is it worth it?"

Why are they important?

According to **expectancy-value theory**, the strength of motivation depends on two main factors: **the person's expectation of achieving the goal and the value that goal has for them.** These factors will influence:

- **investment of effort** – for example, a student will make an effort to get a high grade if they believe they can achieve it and if a high grade is a worthwhile goal for them. If either of these factors is 0, there will be no motivation;
- **choice of tasks** – students with a stronger achievement motive tend to choose tasks of moderate difficulty (realistically achievable), while students with a weaker motive tend to seek out extremely easy or difficult tasks (easier tasks allow "easy success", while more difficult ones can serve as an excuse for not succeeding).

PRACTICAL APPLICATION – RECOMMENDATIONS FOR TEACHERS

How can the classroom become a place that supports learning, engagement and motivation?

There are various strategies for motivating students. Some are presented below, with a focus on strengthening intrinsic motivation, a growth mindset, self-efficacy and student autonomy.

- **Identify students' interests** – you can talk with students and try to find out what their interests are and then connect them in an engaging way to the material and the tasks you set.
- **Associate lessons with positive emotions** – create surprises and stimulate students' curiosity, arrange the classroom in a welcoming way and encourage mutual collaboration and respect.
- **Use interesting materials and authentic tasks** – choose tasks linked to everyday situations students encounter outside the classroom and present them in the form of problem solving, research, debate or discussion…
- **Build positive expectations of students** – instead of just pointing out that the material may be complex, express your expectation that your students will succeed ("I understand this material may be confusing, but with a little practice you'll master it!").

- **Value the learning process itself, including mistakes** – draw attention to the fact that learning is not linear and that confusion, mistakes and misunderstanding are welcome parts of the process ("It's fine to make mistakes. Let's not make fun of them, because that's where real learning begins!").
- **Offer more choice and support** – avoid controlling language ("you have to"), give students the opportunity to choose, but make sure the number of options remains relatively limited ("You can do your homework in the form of: an interview, a text or a drawing. If you need help, we can arrange a time to clear up any doubts").

- **Use constructive feedback** – practise giving students feedback, making sure it is not only quantitative (in the form of a grade), but also qualitative — in the form of suggestions and guidance ("This homework is really very good! You could have developed the idea about… a bit more. It's very interesting").
- **Provide sufficient challenge** – when you see that students have mastered the essentials of the material, give them enough stimulation through more challenging tasks that are not too difficult, but can be overcome with the support of the teacher and classmates.

- **Value effort rather than ability** – when you notice that students are working hard and investing effort to achieve their goals, praise them specifically, highlighting their dedication ("Well done! You can tell you really put effort and time into this!").

- **Be a model of motivation for learning** – show enthusiasm for what you teach.

CONCLUSION

In this chapter, we explored the concept of motivation and analysed the factors that can influence student motivation. Although there are countless factors affecting motivation, this chapter addressed the following: needs, interests and emotions, beliefs, expectations and goals. We also became acquainted with various strategies for motivating students. As a teacher, you can promote student motivation in many ways, but the most important thing is to recognise these factors and integrate them into the learning process. Remember the key points:

- The classroom and the learning space are organised to support learning.

- Use sufficiently interesting, challenging and authentic tasks.
- Support learning, show positive expectations and cultivate a growth mindset.

- Give students sufficient choice and opportunities.

QUESTIONS FOR REFLECTION

1. Have you already applied any of the motivation strategies mentioned in your practice? Are there strategies you have not yet used that you consider useful for future work?
2. Which of the motivation strategies mentioned do you consider most effective?
3. Can you recall situations in which your students were particularly engaged and motivated? What do you think were the key factors that motivated them?

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Classroom management

CLASSROOM MANAGEMENT

LEARNING OUTCOMES

The teacher will be able to:

- explain the concept of classroom management
- understand the difference between a preventive and an interventive approach
- recognise two different classroom management styles in teachers
- apply constructive principles of classroom management in a preventive sense
- apply constructive principles of classroom management in an interventive sense

KEY CONCEPTS

- Classroom management
- Preventive approach
- Interventive approach
- Obedience model
- Responsibility model
- Principle of minimal intervention

INTRODUCTION

Hana recently started teaching Psychology at a secondary school. From the start, she had planned numerous activities and had a very creative streak when it came to teaching and working with students. Her greatest fear was not being able to "keep order" in the classroom and that the students would not listen to her. After a few lessons, she realised that this was precisely what she was struggling with: while she was teaching, half the class was not paying attention, most were constantly on their phones, they chatted among themselves and a good number of them were simply — uninterested.

Questions for reflection:

What do you think — why did Hana's greatest fear come true?

What exactly would you do if you were in her place?

WHAT IT MEANS TO MANAGE A CLASSROOM

Classroom management is a set of planned and intentional activities by the teacher, aimed at organising work, regulating behaviour and building a positive climate in the class,

so as to create the ideal conditions for the learning and development of every student.

Classroom management can be approached in two ways: preventive and interventive. The **preventive** approach consists mainly of creating a positive classroom environment, so that inappropriate behaviour does not even arise. A pleasant, safe and respectful environment is built from the very first day. This is what every teacher should aim for. The **interventive** approach involves the teacher's responses to inappropriate behaviour that has already occurred, with the aim of restoring order and allowing the lesson to continue effectively.

How do teachers manage the classroom?

When discussing classroom management, some authors point to two frequent styles – the obedience model and the responsibility model (see Vizek-Vidović, 2014). These can be associated with two dominant parenting styles — authoritarian and democratic (*authoritative*). ***The obedience model*** (authoritarian teacher) values and imposes an absolute, rather than functional, way of thinking about rules. This means that students are expected to comply with and conform to the rules, anticipating reward or punishment, without questioning why these rules are important. ***The responsibility model*** (democratic teacher) involves seeking to explain to students why certain rules exist and why they are important for the functioning of the whole class. The teacher is willing to discuss this with the students for as long as necessary, so that they understand and internalise the reasons for these rules. Teachers should follow the responsibility model and seek to prevent disruptions in the lesson by organising the flow of activities effectively.

Questions for reflection:

Which management style do you recognise in yourself?

Which do you consider more effective and better? Why?

PRACTICAL APPLICATION – RECOMMENDATIONS FOR TEACHERS

1. Preventive classroom management – how to create a positive learning environment? – *Prevention is better than cure*

A) Defining rules – what do we actually want from students?

To manage a classroom effectively, we must first **clearly define the rules** we want students to follow. There should not be too many — ideally between 5 and 7, although the exact number should reflect the students' age, the needs of the class and the teaching context. What matters is that they are clearly presented to students **in the first lesson of the new school year**. At that point, explaining and discussing the rules should take as long as necessary for students to **understand** and internalise them.

Once the rules have been clarified on the first day, there is no need to return to them in subsequent lessons, but it is useful to **display them** in a highly visible place in the classroom. When formulating the rules, they should be expressed **positively**. What does this mean? It means that we will not say *what is not allowed, what is forbidden*, but rather *what is expected, what is desirable*. For example:

✓We will arrive at school on time.	✗ We will not arrive late.
✓We will listen carefully.	✗ We will not chat during the lesson.
✓We will raise our hand when we have a question.	✗ We will not all talk at the same time.

As students are not usually used to collaborating with others during lessons, especially in STEM subjects, including Informatics, rules for successful collaboration are integrated into each Co-CREATE lesson. Rules and tasks must be clearly described, so that students do not have too many questions that interrupt the lesson or engage in disruptive behaviour.

Classroom rules are not just the teacher's rules — they are **in the interest of everyone in the class**. This is one of the most important things students need to internalise implicitly. It is therefore important to explain to students **why** a rule exists, involve them in a discussion about it and, ultimately, define the rules **in collaboration with the students**. In this way, students will be more inclined to follow them — because they will consider them their own and will see the values underlying them.

Finally, **consistent responses** to rule breaking are important, although teachers should take into account the context, students' developmental needs and the intention behind the behaviour before deciding on the most appropriate response.

Questions for reflection:

Think — which five rules would you single out as the most important?

B) Organising the workspace as a safe place

The space in which teaching takes place every day may be more important for classroom management than it might seem at first sight. Therefore, the classroom should be arranged and organised so that:

- everything the teacher presents is **visible** to all students;
- each student has **enough space** to work without disturbing others;
- it has an effect of **symbolic identification**, meaning that the space is arranged in a way that says something about the students and is special to them — for example, it can

include shared memories of school trips, a board with their work, a corner for all kinds of interests…;

- **distractors** that divert attention are kept to a minimum.

Distractors are all the things that divert students' attention from the lesson. They can include all kinds of external disturbances, such as noise, events outside the room that students can see or hear through the window, general restlessness among them…

In these situations, **the arrangement of desks** can be very helpful when adapted to the lesson plan. If individual work is planned and concentration on the task is important, it is best to arrange the desks in rows. On the other hand, for group work, two or three desks together are the best solution, as students will find it easier to talk and collaborate. If a lot of discussion with students is planned, desks arranged in a semicircle will encourage group conversation, as everyone can see each other easily and take part in the discussion more readily. Teachers should also move around the room, rather than sitting in one place or writing on the board for a long time.

Questions for reflection:

Which of these desk arrangements best suits your subject and teaching style?

C) Time management – lost time is hard to recover

For a lesson to be as effective as possible, all factors that reduce the time available for work should be minimised.

Questions for reflection:

Think — what are the most frequent off-task activities that steal time from the lesson?

Often, because someone arrives late or because of some technical problem, the lesson starts 4 to 5 minutes after the bell. If this happens once or twice, it is, of course, not a problem. However, if it becomes a habit and turns into an "unwritten rule", students will implicitly adopt the attitude that they can be a little late, chat at the door, etc. It is therefore important to prepare them to start working as soon as the bell rings. To do this, the teacher can start the lesson with something **important** or something **engaging** that captures their attention. Likewise, it is not good practice to frequently end the lesson early, as this will, consequently, reduce students' interest and concentration at the end of each lesson.

To maintain attention and concentration, small-group work can be very effective. It is very important to allocate enough time to group activities and to make all the necessary materials available in advance, so that students have enough time and resources to solve the task. Well-structured small-group work allows the teacher to monitor students' work more actively and directly, while students will feel

greater responsibility for what they do, which will motivate them even more. In addition, many students will feel more comfortable asking about what they do not understand, sharing their ideas, etc., and will receive feedback more quickly.

In CSCL activities, pair and group work is essential. One of the challenges teachers may face is forming student groups appropriately. For short, time-limited activities, it may be appropriate to let students choose their own groups. For more complex collaborative tasks, however, teacher-defined groups tend to be more effective. Although heterogeneous groups generally require more time to develop trust and establish effective working dynamics, they better reflect the demands of real-world collaboration by bringing together students with different abilities, experiences and perspectives. When implementing the Co-CREATE lessons, teachers can use digital tools to facilitate group formation. Flippity Random Name Picker and Classroomscreen allow random or semi-random grouping, while Mentimeter or Poll Everywhere can be used to carry out quick polls in class to identify students' preferences, prior knowledge or level of readiness, enabling more informed and intentional grouping decisions. In general, the teacher's physical proximity, active monitoring of students' progress (in person or online) and frequent formative feedback reduce opportunities for off-task behaviour and increase student engagement.

2. Interventive classroom management – *less is more*

When problems arise, the teacher switches to an interventive mode of classroom management, that is, responds to inappropriate behaviour. In these situations, it is good practice to follow the **principle of minimal intervention** (Vizek-Vidović, 2014), which essentially says that we should not make a big fuss if the problem can be solved more simply. We will explain this principle with a concrete example.

Let us imagine a situation in which a student has started talking excessively and distracting the classmates sitting near him.

What would the response of a teacher guided by the principle of minimal intervention look like?

Step 1 – Non-verbal signals

A meaningful look directed at the student, or a subtle approach, always without interrupting your talk, so as not to draw too much attention to the student or disturb the concentration of the rest of the class.

Step 2 – Praising appropriate behaviour

When the student behaves in the opposite way to the undesired one — that is, in this case, when they are quiet and listening carefully — that behaviour should be **praised**. If the behaviour seems to be maintained mainly by attention, **minimising the attention given to minor disruptions**, while at the same time reinforcing appropriate behaviour, can be effective. Why is this important? In fact, the underlying reason for undesired behaviour is

often the rewarding effect the child gets from the attention they receive — from the teacher and, even more importantly, from classmates. If this is the case, even negative attention becomes preferable to no attention.

Step 3 – Praising the other students

If the student continues to insist on talking and disturbing those around them, praise the students who are quiet and not disturbing others, thus respecting the lesson and the teacher.

→ "It's excellent that you're listening carefully and keeping the room calm."

Step 4 – Direct request

The next step, applied if the previous ones do not work, is a direct request addressed to the student: "Aleksa, stop talking and distracting the others!"

Step 5 – Repeated request

If Aleksa does not stop talking, repeat the request calmly and consistently, avoiding escalation. — It is important to be persistent and convey that you are serious about what you are asking. If it seems that they are testing the limits, it is important to **ignore** it again and not react.

Step 6 – Consequences

This is the last resort, to be used only if nothing of the above works. One of the most important things here is also the teacher's confidence in what they say. Therefore, before making a statement such as *"if you do this, that will happen"*, we must be sure that we will follow through.

Questions for reflection:

Which of these approaches do you use most often? How effective do they prove to be?

A few more notes on rewards

- Rewards can be an "ally" in eliminating undesired behaviour — they should immediately follow the desired behaviour!
- At first, reward (praise) the child frequently, but after a while reduce the frequency (there is no need to reward the desired behaviour every time or to give excessively large rewards).
- Do not announce rewards in advance (along the lines of: "If you do… then…"), but sometimes it is not a bad idea to skilfully apply the so-called Premack principle (if the reward is earned and follows the effort, it motivates)!
- The reward (praise) should have informative value (indicate specifically what the child did well) and should be personal!
- Encourage attempts (giving support), but reward successful solutions!
- Complex skills should be divided into smaller units, and the child should be rewarded for each unit mastered successfully!
- Do not compare the child with other children, but with themselves (with their previous results)!
- Apply different reward criteria for children with different abilities and prior knowledge!

CONCLUSION

Effective classroom management involves creating a safe, supportive and stimulating learning environment. Classroom rules should be clear, formulated positively and accepted by students through discussion and shared agreement, thus promoting their sense of responsibility and belonging. The organisation of the physical space, the minimisation of distractors and the intentional grouping of students further contribute to maintaining attention and motivation. Allocating enough time to activities, providing the necessary resources (for example, data, links and materials), continuously monitoring students' progress, ensuring smooth transitions between activities and providing timely support (*scaffolding*) are essential for effective classroom orchestration. When disruptive behaviour occurs, teachers should apply the principle of minimal intervention, responding progressively — from subtle non-verbal signals and the reinforcement of appropriate behaviour to direct requests and, when necessary, appropriate consequences.

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Participation

PARTICIPATION

LEARNING OUTCOMES

After completing this chapter, teachers will be able to:

1. Explain the importance of student participation for the quality of learning and for the development of competences (critical thinking, collaboration and responsibility).

2. Recognise the difference between passive and active student participation in the learning process and its effects on learning.
3. Reflect on their own teaching practice and analyse it in relation to the level of student engagement.
4. Design activities that enable all students to participate, including those who are less inclined to volunteer or speak up.
5. Develop a safe and supportive classroom environment in which students feel comfortable expressing their opinions.

EXAMPLE

A classroom was like an orchestra. The teacher was the conductor and the students were the musicians. At the beginning of the school year, only the conductor played — explaining the content, asking questions and giving the answers. The students stayed silent and simply took notes. The music was there, but it sounded rather limited.

One day, the conductor lowered the baton and invited the students to join in. One student asked a question nobody had thought of before. Another related the material to a film they had seen. A third shared a different perspective and started a discussion. Each new voice added another instrument to the orchestra. By the end of the lesson, the room was full of diverse ideas. The teacher was still conducting the orchestra, but the music was no longer created by one person alone. It was created together.

At that moment, the students realised that a lesson is not a concert they simply attend, but a composition in which they too have their own part to play.

Questions for reflection:

- *To what extent is it only the "conductor" who plays in my lessons, and to what extent do students actively contribute to the learning process?*
- *Which students participate most often in lessons and whose voices are heard less?*
- *In what ways do I encourage students to ask questions, express their opinions and propose ideas?*
- *Do students have the opportunity to influence the direction of the lesson, the choice of activities or the ways of working?*
- *How do I create an environment in which students feel safe to speak without fear of making mistakes or being judged?*
- *What obstacles to greater student participation do I recognise in my teaching practice?*
- *How can I engage students who are more reserved or rarely take part in discussions?*
- *How do I check whether all students feel heard and valued?*
- *What could I change in my next lesson to increase students' active participation?*

STUDENT PARTICIPATION – CONCEPT AND IMPORTANCE

Student participation refers to the active involvement of students in the learning process and in decision-making related to teaching and school life. It means that students are not merely passive recipients of information, but active participants who ask questions, express their opinions, collaborate with others, propose ideas and take responsibility for their own learning.

Student participation can take place at several levels:

- **In the classroom** – through discussions, group work, questions, suggestions and solving problems together.
- **In lesson planning** – when students take part in choosing topics, ways of working or projects.
- **In assessment** – through self-assessment, peer assessment and reflection on their own learning.
- **In school life** – through the student council, extracurricular activities, projects and community initiatives.

WHY IS STUDENT PARTICIPATION IMPORTANT?

Student participation is essential because it changes the nature of learning — from passive listening to an active and meaningful process, in which students construct knowledge rather than simply reproducing it. Therefore, contemporary education is based not

only on the transmission of knowledge, but on creating opportunities for students to participate, explore and build understanding together.

1. Deeper and more lasting learning

When students participate actively (for example, through discussion, questions and problem solving), they develop a deeper understanding of the content and retain knowledge for longer.

2. Development of key competences

Participation supports the development of:

- **critical thinking**,
- **communication skills**,
- **collaboration and teamwork**, and
- **autonomy, responsibility and proactivity**.

3. Greater motivation to learn

Students become more engaged when they feel their voices are heard and valued. Learning becomes personally meaningful, not just an obligation. Students begin to see learning as something that belongs to them and to which they actively contribute.

4. Sense of belonging and psychological safety

When students participate, a climate of trust develops. The classroom becomes a place where students feel comfortable expressing their opinions, asking questions and making mistakes as part of the learning process.

5. Developing responsibility for one's own learning

Students who participate actively are more likely to take responsibility for their learning. Instead of depending only on the teacher, they become active contributors to the learning process.

6. Preparation for life beyond school

Through participation, students learn to express their points of view, listen to others, make decisions and collaborate — essential skills for everyday life, for further study and for active citizenship.

> Without student participation, teaching may seem "calm and well organised", but it often stays on the surface. With meaningful participation, learning becomes dynamic, purposeful and valuable in the long term!

HOW TO CREATE ACTIVITIES IN WHICH ALL STUDENTS PARTICIPATE

- **Use activities that require everyone's involvement.** For example, *think–pair–share*, pair work or small-group activities, in which every student has the opportunity to contribute.
- **Ask open-ended questions.** Instead of asking *"Who knows the answer?"*, ask: *"Why do you think this happens?"* Multiple possible answers create opportunities for more students to participate.
- **Give time to think.** After asking a question, pause briefly. Students who need more time to formulate their ideas will then be more likely to participate.
- **Rotate roles within groups.** Assign roles such as note-taker, presenter or moderator, so that each student has a specific responsibility.
- **Include different ways of expressing ideas.** Combine speaking, writing, drawing and digital tools, as students may feel more comfortable expressing themselves in different ways.

HOW TO CONSULT STUDENTS

- **Ask short reflection questions.** At the end of a lesson, ask: *"What was the clearest part of today's lesson?"* or *"What was the most difficult?"*
- **Use quick polls or voting methods.** Hand signals, response cards or online tools can help students give feedback quickly and easily.
- **Introduce a suggestion box or anonymous feedback options.** This is particularly important for students who are less inclined to speak during discussions.
- **Discuss learning preferences and ways of working with students.** Ask: *"How would you prefer to learn this topic?"*
- **Show that students' ideas matter.** When a student suggests a useful idea, acknowledge it and, whenever possible, put it into practice or refer back to it in future lessons.

HOW TO INVOLVE STUDENTS IN DECISION-MAKING

- **Offer choices whenever possible.** For example, let students choose the topic of a project, the format of a presentation or the order of activities.
- **Develop working agreements together.** At the beginning of the school year or of a new topic, involve students in setting rules and expectations. They are more likely to keep to agreements they helped create.

- **Involve students in planning activities.** For example, ask: *"How could we approach this topic?"*
- **Enable self-assessment and peer assessment.** By taking part in assessing the quality of their own work and the work of others, students develop responsibility and learn to apply quality criteria.
- **Create space for student initiatives.** Encourage projects, small research activities and presentations designed by students, allowing them to take on a more active role in the learning process.

Remember:

Small changes can make a big difference: student participation does not mean giving up control, but rather sharing the learning space with students.

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Inclusive education – students with SEND and gifted students

INCLUSIVE EDUCATION – STUDENTS WITH SEND AND GIFTED STUDENTS

LEARNING OUTCOMES

The teacher will be able to:

- explain the concept of inclusive education and its importance
- understand the importance of active participation in education
- distinguish inclusion from integration
- illustrate the importance of the biopsychosocial model in relation to people with developmental disabilities
- use the ecological model of education to better understand a person's educational situation
- identify the need for additional support in children and determine in which domains help is needed
- analyse the relationship between their own beliefs and behaviours and their students' results

KEY CONCEPTS

- Inclusive education
- Integration
- Participation in education
- Children who need additional support
- Medical model vs. biopsychosocial model of inclusion
- Ecological approach to education – Bronfenbrenner's approach
- Pedagogical profile
- Golem and Pygmalion effects

INTRODUCTION



Figure 1. Inclusive values 1 *Comic text:* "It's impressive how well you've adapted your teaching now that you have students with severe disabilities in your class." – "Well, I just remind myself that my students were all different before 'inclusive education'; that hasn't changed, it has only broadened." *Caption:* Mrs King wears her old softball cap to remind herself that individualising to meet each student's unique needs is old hat for good teachers. Source: facebook.com/ActionDrivenEducation

The comic above actually shows how people often mistakenly think that inclusion is a major change that significantly alters the way teaching is done, that it is an "add-on" to the mainstream education system and that it has certain consequences for the knowledge of other children who do not have a visible disability. However, what lies at the heart of inclusive education, namely *adapting to children's individual differences*, has always existed, because children have always differed in their abilities, pace of learning, interests, etc. In other words, differences between children have always existed; inclusion simply makes them more evident and visible. This is also suggested by the cap worn by the teacher in the comic — good, long-standing practice with children shows that inclusion is an old concept, now simply formalised and supported by significant scientific evidence.

Questions for reflection:

In what ways can children differ from one another?

What differences do you recognise among the children in your class?

INCLUSIVE EDUCATION

Diversity among children is a common and normal aspect of human development and existence, because being different and differing from others is part of our nature. A classroom is like a miniature world — one child's parents are getting divorced, another has broken a leg, another comes from a disadvantaged socioeconomic background, one has dyslexia, another is being bullied and another may struggle to fit in because they are gifted. The concept of inclusion draws attention to the fact that *any child* may have difficulties engaging in education, taking part in social interaction or learning the material set out in the curriculum, whether or not they have a disability.

Important!

All children may, at times, need additional support, but this does not mean that every child who is different from others needs help. There is no exhaustive list of children or situations in which children will need support, which is why it is important to carefully assess who needs support and in what way.

The difference between integration and inclusion

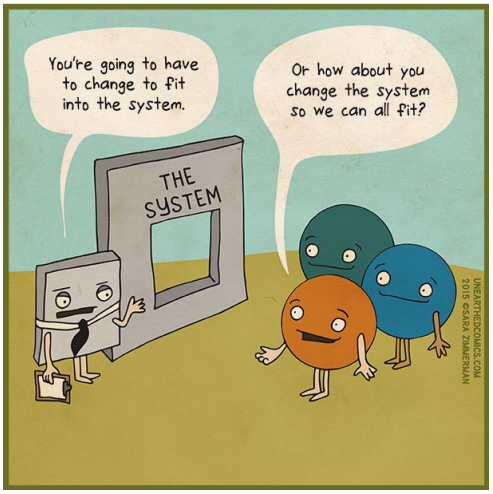

Figure 2. Inclusive values 2 *Comic text:* "You'll have to change to fit into the system." – "Or how about you change the system so that we all fit?" Source: https://tapas.io/episode/180487

The image above illustrates a situation in which the system, believing itself to be inclusive, requires its students to change so that they can get in and become active members of the community. The process depicted in the image, often mistakenly understood as inclusion, is in fact integration. **Integration** refers to the process of enrolling students with developmental disabilities in existing mainstream educational institutions, provided that *the student can adapt* to the demands of that institution. If we used the example of a child who uses a wheelchair, integration would mean that no additional changes would be made to the organisation

of tasks, the adaptation of teaching methods or the curriculum — because the student has already been "included" in the class. **Inclusion** is the process of reforming institutions and systems as a whole, so as to guarantee all students an experience of equal *access* to and *participation* in school. This involves adapting the educational environment to students' needs and abilities, finding ways to support and value differences and accepting that these differences can be a source of learning and well-being for the whole community.

Why is participation so important?

Youth participation refers to **involvement** in shared activities and in the environment typical of their group. Through these interactions with the social environment, skills develop that will serve young people in their future participation in society, reinforcing their sense of belonging and self-esteem.

Questions for reflection:

Imagine that in a class there is a child who uses orthopaedic aids, as well as a child who uses a wheelchair. What makes that class inclusive?

Is it enough to enrol these children in existing mainstream educational institutions? Why?

Models of relating to people with developmental disabilities

Questions for reflection:

Imagine that in your class there is a boy called Marko who has autism. To what extent does this information help you understand Marko's needs?

To what extent do you understand his specific experience?

What additional information would make it easier for you to better understand Marko's experience and adapt your lessons to his needs?

For children like Marko, and for all those with developmental disabilities, the way their difficulties are defined from the perspective of the education system is very important, as this will influence the approach that the institution — and, consequently, the teachers — will take towards that person. This section of the chapter describes the medical model and the biopsychosocial model in relation to people with developmental disabilities.

1. <u>Medical model:</u>

- Explains developmental disabilities as the result of health problems.
- The focus is on the medical causes (aetiology) and characteristics of the person's condition. The diagnosis functions as a fixed label that categorises the student in a particular way.

- Consequences of this model:
  - *Social dynamics are neglected*; the person with a disability is reduced to their diagnosis, i.e. to a category, which means that this model is not sensitive to changes in the person's level of participation in the community, nor can it represent the influences and limitations the environment imposes on them.
  - A student's diagnosis *does not provide teachers with the necessary information* about interests, abilities, learning experiences and aspirations — simply put, it gives them no basis for acting within their area of competence. This leaves teachers feeling powerless, because they lack information on how to enable students to receive a quality education.
  - Developmental disabilities are treated as *a condition to be treated by a doctor*, so disability is seen as the result of a health problem. This demand for treatment — that is, correction and rehabilitation — focuses only on the person, leading to the neglect of other factors that may contribute to developmental disabilities. Furthermore, the medical model places the teacher in a position of dependence on other specialists when it comes to teaching these students.

2. <u>Biopsychosocial approach:</u>

- Offers a holistic and integrative view of developmental disabilities: they are defined through the interaction between medical conditions, individual psychological responses and the social environment.
- Holds that a developmental disability is a complex phenomenon that cannot be seen through a single (medical) approach, but requires attention to students' mental health, as well as to their environment, which should be inclusive and supportive.
- Implications of this model:
  - *A multidisciplinary approach* is needed to enable an individualised response to the needs of students with developmental disabilities.
  - It makes it possible to *contribute to students' overall well-being*, focusing not only on the medical (biological) aspects of developmental disabilities, but also on the social and psychological ones.
  - It helps to *understand the student's position and behaviour* (thanks to this model, we can ask whether learning difficulties resulted from an underlying physical problem or from a lack of support from the teacher). Learning is no longer seen in isolation from psychological and social factors, which consequently opens up space for inclusion and greater student participation in teaching.
  - *The student's functioning*, as well as *the developmental disability*, are seen *as a continuum*. This also allows that, at certain moments or in certain

situations, the student may demonstrate a higher level of functioning, which helps in understanding the student and adapting better to their needs.

- The ultimate goal is *participation*, because inclusive education means ensuring that all children reach the highest level of their potential; participation is both the goal and the means of achieving it. By ensuring young people's participation in school, a path is opened to future success and fulfilment, forming the basis for their participation in society.
- The focus is placed *on the situation* in which the person finds themselves, and not on the person as such. For this reason, this model can also be used to identify the factors that hinder or support students' education. In this sense, the teacher's role shifts from depending on external specialists to becoming an active participant in the education of young people with developmental difficulties (adapting teaching, recognising students' obstacles and strengths).

With the biopsychosocial model, the question is no longer: "What is wrong with Marko?", as that would follow the medical model of defining developmental disabilities. Instead, you can ask: "What in Marko's environment can be changed so that he can take part in lessons without obstacles?" By asking questions about Marko's interests, his experiences of learning and teaching, his motivation or his challenges, we get a much broader picture of how teaching can be adapted to support his strengths and enable greater participation in the lesson.

Ecological approach to education – Bronfenbrenner's approach

Inclusive practices involve not only integrating students into the peer group, but also actively enabling them — like all other students — to have their voice heard and respected, to take part in activities with other students and, in doing so, to develop relationships within the community to which they belong. This perspective is particularly emphasised by the **ecological approach** to child development and learning.

This approach reminds us that each of us *is part* of some *environment* from which we learn and develop. For the desired changes to occur, it is necessary to activate various segments of the system and of people and bring about changes in their mutual interaction. In this way, it becomes possible to identify learning opportunities or the elements that facilitate learning. The same applies in the opposite direction — the ecological approach makes it easier to identify practices, procedures and measures within this ecosystem that hinder students' progress and education.

The basic elements of the ecological perspective on education are:

- **Macrosystem**: consists of the social norms and rules that shape a particular culture and its customs; these elements influence the functioning of institutions and thus shape everyday life (for example, compulsory schooling policies) — the decisions and responsibilities of the macrosystem exert a cascading influence on all the other, lower levels of the system.

- **Exosystem**: the outer part of the system, which affects the child indirectly (for example, the parents' workplace, social welfare services, relationships with people outside the family, the mass media) — the parents' workplace provides access to health care and social protection.
- **Mesosystem**: represents the relationships established between the different elements of the microsystem — for example, the relationship between the family and the school; the extent to which family values are aligned with those promoted by the school, whether and how parents and teachers collaborate, etc.
- **Microsystem**: encompasses the interactions the child has in their immediate environment (for example, family, peers, kindergarten/school, health centre…).

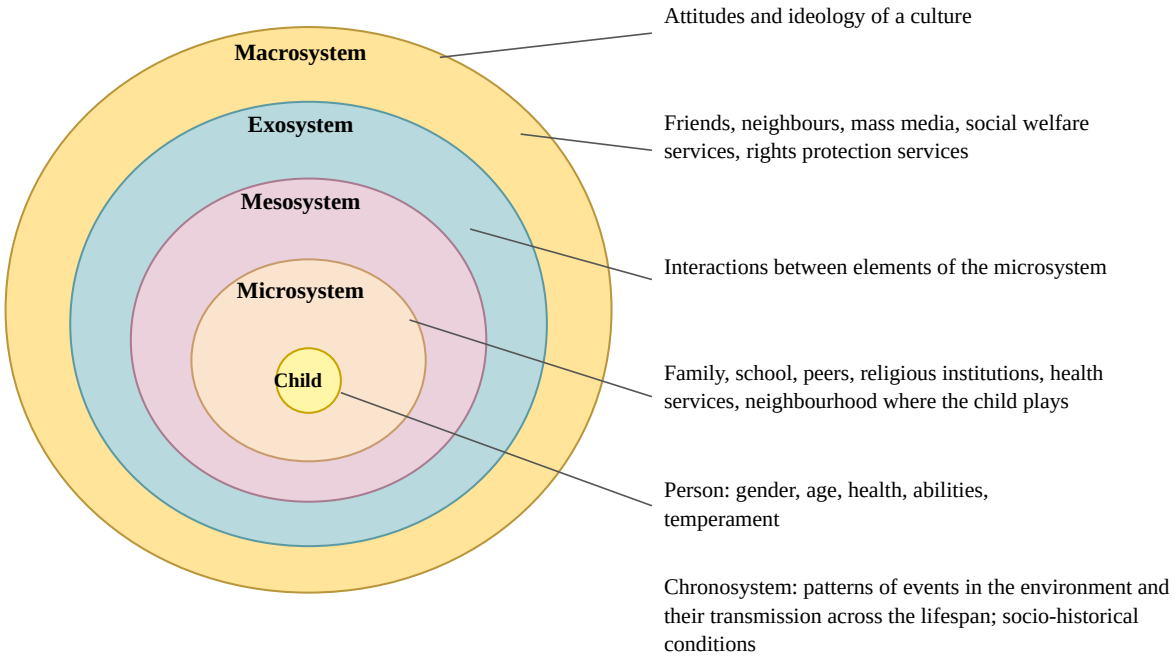

Figure 3. Overview of Bronfenbrenner's ecological model

The essence of this model is that the person is at the centre of the system, surrounded by the relationships formed in society. These relationships and layers of the system form a complex *network of factors that influence the child's development*, creating facilitators or obstacles in education.

Questions for reflection:

Imagine that you have a student in your class called Biljana. She is Roma and lives with her parents and brother in a neighbourhood on the outskirts of the city. Her parents want her to attend school regularly, but sometimes find it difficult to buy all her school supplies and to provide her with a quiet place to study at home. Biljana particularly enjoys maths and happily takes part in group activities. You regularly encourage her to participate in lessons and express her opinions. However, it sometimes happens that some students show prejudice towards Roma children, which makes Biljana feel insecure in the classroom. Her parents sometimes talk to you about her progress, but because of work commitments and the distance from the school, they are not always able to attend parents' meetings. The family uses some social welfare services and there is also an organisation in the community that supports Roma children through workshops and study support.

Based on the ecological approach to education, reflect and try to identify some factors that facilitate and some factors that hinder Biljana's education. Which factors can you directly influence as her teacher?

PRACTICAL APPLICATION – RECOMMENDATIONS FOR TEACHERS

Identifying a child's need for additional support and drawing up a pedagogical profile

The need for additional support can be identified by a teacher, but also by parents, peers or specialists from other fields who follow the child and their progress (educators, paediatricians, speech therapists, etc.). This need is usually identified when a child is not achieving — or is exceeding — the intended and expected learning outcomes, and drawing up a pedagogical profile of the child can also help in this process.

The pedagogical profile is the basic document in planning educational support, drawn up on the basis of **data on the current level of functioning** of a particular student. It is, in fact, a detailed description of the child, their strengths, their learning difficulties and their interests, which makes it possible to understand their educational situation. This document is dynamic, because it requires regular review in line with changes in the child's educational situation, so the steps in drawing up the pedagogical profile are repeated cyclically.

Once the need for additional support has been identified, data about the child are collected. The data are collected from various sources (the child themselves, i.e. the student for whom the profile is being drawn up, peers, the teacher, the family, psychology and guidance services and, if necessary, medical reports) and through various methods (conversation, questionnaire, observation, the student's work portfolio and tests — as needed), in order to obtain as objective a picture of the child as possible. The data focus on the child's environment (whether there are pedagogical, social or physical obstacles in their environment) and on the child

themselves (identifying where support is needed, also taking into account motivation, interests, learning style and the knowledge and skills already acquired).

This is followed by drawing up the pedagogical profile. Unlike a description of the educational situation, the pedagogical profile is written in precise, clear and factual language, so that the text is concise and concrete. The following should be avoided:

- generalisations
- assumptions
- negative statements (for example, cannot, is unable to, does not know, or what problems the child has)
- technical or professional jargon

What does the pedagogical profile contain?

- **Information about learning:**
  - the child's general school results (are there areas in which the child achieves above-average results? is the student's progress noticeably slower than that of other children? are the child's results lower than expected in the area observed?)
  - the current state of thinking skills (reading comprehension, arithmetic reasoning, age-appropriate problem solving, interests, etc.)
  - motivation and attitudes towards school
  - self-perception as a student
- **Information about social skills:**
  - the student's relationships with others (behaviour towards peers and adults, maintaining relationships and contacts, respecting general rules, etc.)
  - ability to adapt to different contexts, self-image and ability to deal with social situations
  - friendships at school, types of play and leisure activities they engage in with peers
  - good communication skills (greeting others, how they take turns in conversation, skills for keeping a conversation going, etc.)
- **Information about communication skills:**
  - which communication channels does the student use to receive or convey information to others?
  - are there visual, hearing or speech impairments, or any other form of communication difficulty (such as in non-verbal communication), that affect the child's participation in education?
  - does the student have full command of the language used in teaching, i.e. the language used by the majority of the group?

- are there difficulties that affect their participation in the educational process?

- **Information about independence and self-care:**
  - how does the child carry out daily responsibilities and activities related to participating in education?
  - are there difficulties related to moving around independently or carrying out daily tasks (are there motor, physical or sensory impairments that affect inclusion and participation in education)?
  - the child's general state of health (are there persistent health problems and how do they affect inclusion and progress in mastering the regular curriculum?)

- **Information about the influence of the external environment on learning:**
  - family conditions (can the parents support learning and regularly provide textbooks and materials? housing conditions; does the child have adequate food and clothing? is the journey between school and home safe?)
  - environmental conditions (does the child live in an environment that offers adequate cultural and sports activities? are there friends of the same age in the neighbourhood? do they socialise, visit each other and study together?)

Why are all these questions important?

Based on the pedagogical profile, the level and type of support needed for learning are determined and the interventions and resources that will enable the child's progress and the fulfilment of their potential are planned. This is particularly important for children who need support in several areas — enabling progress in one domain can create the precondition for progress in others. In addition, thanks to the questions about the child's environment and state of health, needs that require specific measures (such as an extended school day, transport, food support or assistive technologies) are also properly considered.

When we have an objective view of a child's educational situation, as well as being able to plan support according to their individual needs, we also avoid the mistakes that would result from being subjective and acting on the basis of our own beliefs. An example would be a Roma student with difficulties in maths. If the teacher holds negative beliefs about Roma people, they will also have low expectations of their student. These unfounded beliefs will directly affect the student's progress and will not lead to their improvement — this is the so-called Golem effect. However, if we are aware of the student's weak communication skills and the lack of parental support, space is created to act and to help that child.

The Golem and Pygmalion effects

People often tend to look for evidence that confirms their beliefs, or to ignore all information that contradicts them, and these beliefs generate certain expectations.

When we imagine a child with autism, if we are familiar with what that diagnosis implies, we will already have certain beliefs about what a particular student can or cannot do. **The Golem effect**, in this example, would look like this: based on their negative expectations, the teacher behaves in an unsupportive way, which triggers a response in the student's behaviour (disengagement and problem behaviour), thus confirming the teacher's initial beliefs and expectations about that group of students. The alternative possibility is **the Pygmalion effect**: the teacher has positive expectations of a student based on their membership of a group, which leads to supportive behaviour by the teacher and positive responses from the student (for example, positive results). **The teacher's expectations directly influence students' behaviour and progress.**

All Co-CREATE lessons are on the Petlja platform, whose accessibility has been significantly improved through the introduction of a clearer page structure, better screen-reader support and greater visual contrast in the main interface elements. More specifically, headings, landmarks (*landmarks*) and lists have been restructured so that screen-reader users can navigate pages, course content and cards in a logical order, with regions such as headers, main content, filters and carousels now properly marked up and labelled. Interactive components, such as menus, buttons, carousels, modal windows, filters and form fields, have been given appropriate semantic roles, ARIA attributes and labels, ensuring that they are fully operable via the keyboard and correctly announced to assistive technologies. In addition, the colours of links, text, icons and focus indicators have been adjusted to meet WCAG contrast requirements, while decorative and informative images now use appropriate alternative text or are hidden from assistive technologies, reducing noise for those who rely on screen readers.

We sought to ensure differentiation in our lessons, so that students with different abilities and levels of prior knowledge can participate equally. For example, the Co-CREATE lesson on cryptography includes tasks of varying complexity. In the Co-CREATE lesson on pivot tables and charts, teachers can adjust the complexity of the dataset or of the presentation task. In the Co-CREATE lesson on disassembling a computer, teachers can adapt the level and type of tasks involving hand tools to students' needs and abilities.

Understanding giftedness

We began the story of inclusive education by highlighting the many ways in which students can differ. However, gifted, above-average or talented children are not usually the first association people make with inclusion, but this does not mean that mainstream teaching is well adapted to them. In the past, giftedness was associated mainly with high *general intelligence*, whereas more recent perspectives

also include *specific abilities*, as well as other aspects such as motivation, creativity and personality traits. You can read more about specific abilities in the chapter on Multiple intelligences.

The students we describe as **gifted** are, in fact, young people capable of consistently achieving above-average results in everyday activities, and are characterised by high motivation, an exceptional ability to acquire and retain knowledge and the creative use of that knowledge. **Talent** represents a form of innate, above-average ability that enables success in specific areas of human activity. These students have the potential to achieve, or already achieve, high results in various areas: academic, psychomotor, artistic, leadership skills and others.

Although giftedness is considered to comprise a set of innate traits and abilities, realising this potential requires special conditions. Early and accurate identification of the level and nature of giftedness and, based on that information, differentiation of teaching adapted to these students are of great importance in supporting them.

The characteristics of a programme that supports the development of gifted children are:

- broadening their general knowledge and abilities
- respecting their specific interests and learning styles
- deepening their interests
- cultivating creative thinking
- developing specific abilities
- using a variety of sources of information.

Questions for reflection:

Have you come across gifted or talented children? If so, recall your work with that student and, as you read, identify the practices you used and those you felt were missing.

If you have never worked with such students, imagine that you are now working with one of them and, as you read, reflect on how you would apply certain approaches.

There are two approaches used in working with gifted students: acceleration and curriculum enrichment.

Acceleration:

- Mastering the curriculum more quickly or at an earlier age than is usual.
- It is based on the idea that the content of the regular curriculum is suitable for gifted students, but is not accessible to them because of the age barrier.
- What can be done for the child?
    - *starting school before the normally required age*

- *skipping a school year*
- *subject acceleration* — studying content intended for older students in one or more subjects
- *curriculum compacting* — mastering the programme of a particular year in a shorter period
- *extracurricular education* – the student attends summer programmes offered by schools or universities that give additional points for admission to higher education or exempt them from certain exams

- How do these options differ?
  - They differ in the degree to which the gifted child is separated from their peers (extracurricular education does not require separating the student from their peer group, whereas skipping a year or starting school early do require this separation).
  - This is important because skipping a year represents the most demanding form of acceleration — both for the child and for the teachers — which is why it is necessary to identify and prevent in advance any emotional and social challenges associated with the transition to a new environment.

Curriculum enrichment:

- It is based on ideas similar to those of acceleration (gifted students learn faster and faster mastery of the curriculum will better meet the child's needs).

- The fundamental difference — *the curriculum content is considered too uniform* and does not meet all the needs of the gifted child, and *the teaching approach relies too much on routine* (the regular programme offers a limited set of knowledge and skills, neglects creativity and understanding, is not engaging enough and does not allow the kind of application gifted children seek).

- The criterion for curriculum enrichment is the child's interest and their area of giftedness, so as to support their cognitive, emotional and social development, avoiding irrelevant enrichment.

Both approaches lead to better support for students, which is why both are used and carefully combined today. More important than knowing which approach is best is probably the question of the teacher's attitude, because it determines whether the child will be supported, encouraged and able to build self-confidence — or whether they will suppress their interests and fail to develop their creativity and critical thinking.

QUESTIONS FOR REFLECTION

1. What is your greatest obstacle to implementing inclusive practices and how could you overcome it?

2. When you think of a student with difficulties, do you focus more on the "problem within the child" or on the obstacles in the environment? How would applying the biopsychosocial model change your perspective on that student?
3. Do all students in your class have the opportunity to participate actively in teaching? If not – which students are least included and why?
4. What information about students do you most often miss that could be important for lesson planning?

CONCLUSION

Inclusive education is not a radical novelty in the education system, but rather a tool that has been given an appropriate name and a formal foundation. Unlike integration, which requires students to adapt to the system, inclusion transforms the system to guarantee a quality education for all children. In inclusive education, special attention is paid to students with developmental difficulties. The biopsychosocial model of approaching people with developmental difficulties offers a broader and more realistic framework for understanding these students, as it takes into account the interaction between personal characteristics and environmental factors. This opens up space for a more active role for the teacher, who is no longer a passive executor of the curriculum but becomes a key actor in creating a stimulating and accessible learning environment. Just as teachers are not isolated units within the education system, students are not disconnected from their environment, culture and community. This is precisely why Bronfenbrenner's ecological approach to education stresses the influence of a large number of factors on a child's educational situation and encourages teachers to develop a deeper understanding of that situation. This prevents the Golem effect and allows the child and their situation to be accepted, together with active planning of the support the teacher can provide. In planning this support, the pedagogical profile is the basic document through which the main areas to work on are identified, as well as the student's strengths, abilities and motivations and, in general terms, their current level of functioning.

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Resources for further learning:

1. https://youtu.be/CtRY_1mZWWg?si=O6o42nm7lmhqH2C4
2. https://youtu.be/K-AWPB8adE4?si=ovmni7LTPU2fELHx
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4. https://www.simplypsychology.org/bronfenbrenner.html

The teaching cycle: planning, delivery and evaluation

THE TEACHING CYCLE: PLANNING, DELIVERY AND EVALUATION

ISSUES ADDRESSED IN THIS CHAPTER

In this chapter, we will address issues related to the planning, delivery and evaluation of lessons, as well as the interrelationships between these elements. We will begin with an overview of their interdependence (Diagram 1), followed by a more detailed discussion of how (and why) we plan teaching, how we deliver it and how we evaluate it. Throughout these three sections, we will explore together the following questions: how we plan the teaching process, why it is important to plan lessons, what factors influence this planning and how we define objectives and learning outcomes. We will then discuss the importance of choosing teaching methods, as well as the social forms of organising teaching. We will also address the factors that can influence the choice of methods and share some methods you can use in your work. This can be related to the ideas presented in the previous chapters on Motivation and Classroom management. Finally, we will turn to the evaluation of teaching, including student assessment, assessment criteria and assessment methods.

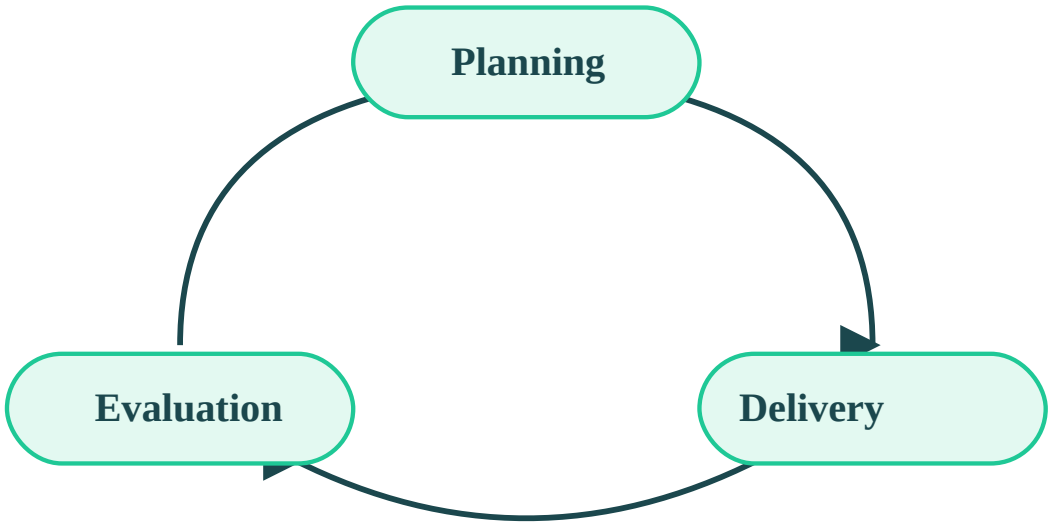


Diagram 1. *Interdependence between lesson planning, delivery and evaluation*

Planning, delivery and evaluation should be seen as **interconnected** and **mutually dependent** phases of the teaching process. As this diagram shows, planning, delivery and evaluation cannot be seen as linear or isolated; on the contrary, they take place in a cyclical process in which each phase follows naturally from the previous one and directly influences the next. In this sense, the teacher starts by planning the teaching process, defining objectives, content, teaching methods and teacher and student activities; then delivers the teaching and afterwards, through evaluation processes, reviews

the learning achieved and the teaching process itself. Therefore, we do not speak of evaluation as the end of the teaching process, but rather as **one of the starting points for planning**, through which teaching practice develops continuously.

LEARNING OUTCOMES

By the end of this chapter, the teacher will be able to:

- Explain the importance of lesson planning
- Identify various factors that can influence lesson planning
- Distinguish between different types of plans (global, operational and written lesson plan)
- Formulate clear objectives and learning outcomes

KEY CONCEPTS

- Objectives
- Learning outcomes
- Bloom's Taxonomy
- Global work plan
- Operational work plan
- Written lesson plan

INTRODUCTION

Teacher Marko, textbook in hand, was heading to the room where he had his first lesson that Monday. On the way, he was thinking that he had not specially prepared this lesson. Still, he told himself that he had taught the topic "The First World War" so many times that he did not need any preparation – he would rely on experience. "Anyway, that topic is in the book," Marko thought as he approached the room. He went in and greeted the students. Then he introduced the topic and the aim of the lesson to the students and wrote the title on the board. Teacher Marko began teaching and, from time to time, wrote important dates and historical figures on the board. Although it seemed to him that the lesson was going "naturally", at the end he realised that the students had not connected the key figures with the dates. Some were confused, others passive and others simply waiting for the lesson to end.

Meanwhile, in another room, teacher Jelena was teaching the same unit to another class in the same year. Immediately before the lesson, teacher Jelena planned it, guided by the following questions:

- What do I want my students to learn today?
- How will I know whether the students have learned?
- What activities will lead the students to understand the material?

Teacher Jelena asked herself key questions in order to design a quality lesson plan. She reflected on the learning outcomes, planned the students' activities, the methods and forms of work she would use and how to adapt the activities to the characteristics of the class. Finally, she also thought about the assessment methods. Her lesson was clearly structured and the students understood what they were doing and why.

Questions for reflection:

Do you think the teacher's experience is essential for effective delivery of the teaching process?

Is it always necessary to plan lessons?

What do you consider most important in planning a lesson?

Why do you think teacher Jelena planned an assessment activity?

PLANNING THE TEACHING PROCESS

In the broadest sense, planning the teaching process means linking various elements (content-related and organisational) into a unified system of work. We also speak of lesson planning as **a dynamic and continuous process**, in which teachers systematically reflect on objectives, methods, content, activities and forms of assessment. Thus, lesson planning should answer at least three questions:

- *how the work will be carried out* (choice of methods)
- *why it will be carried out* (purpose, objective)
- *what will be covered* (choice of content)

Quality planning of the teaching process brings **clarity, confidence and flexibility** to the work. A teacher who plans teaching thinks not only about *what* they will teach, but also about *why*, *how* and *how they will know that the students have learned*. It is therefore important for the teacher to plan teaching:

- in order to know how and what they are doing,
- in order to be able to monitor and evaluate, and
- in order to be able to develop and improve their own practice.

WHAT DOES THE TEACHER TAKE INTO ACCOUNT WHEN PLANNING THE TEACHING PROCESS?

✔Broader context

When planning teaching, it is important to take into account the broader context, that is, to consider:

- the context of the general aims of education

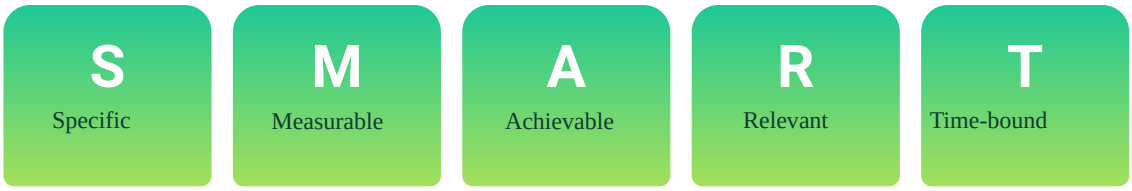
- the context of the objectives of a particular level of education and type of school
- the context of the subject (objectives, learning outcomes and content of the subject concerned)
- the context of the school's common practices
- the characteristics of the local and wider community

Planning Informatics lessons in a health-oriented vocational school is not the same as in a technical vocational school, nor is working in a well-equipped school in the capital the same as in a small rural school.

✓Objectives and learning outcomes

An important question in the lesson planning process concerns objectives and learning outcomes and the relationship between them. Objectives are general and broadly formulated intentions of the educational process, which describe the direction in which teaching should move. In other words, objectives describe the orientations and aspirations to be achieved in the teaching and learning process.

In this sense, objectives should be SMART (see Scheme 1):



Scheme 1. SMART objectives

Stop for a moment and reflect!

Do you start planning from the activities (what should be done during the lesson) or from the objectives (why)?

What do you usually take into account when setting objectives – only the national curriculum or other external factors as well?

Given that mistakes can occur when setting objectives, Benjamin Bloom defined 6 categories of cognitive objectives – criteria used to determine the levels and degrees of knowledge that students should acquire in each subject. Bloom's Taxonomy is one of the most important models in contemporary didactics, offering teachers a structured framework for **planning lessons**, **defining learning outcomes** and **assessing students' knowledge**. The levels of knowledge are organised hierarchically – from lower, reproductive levels to higher, creative levels – which makes it easier for the teacher to plan a gradual and meaningful learning process.

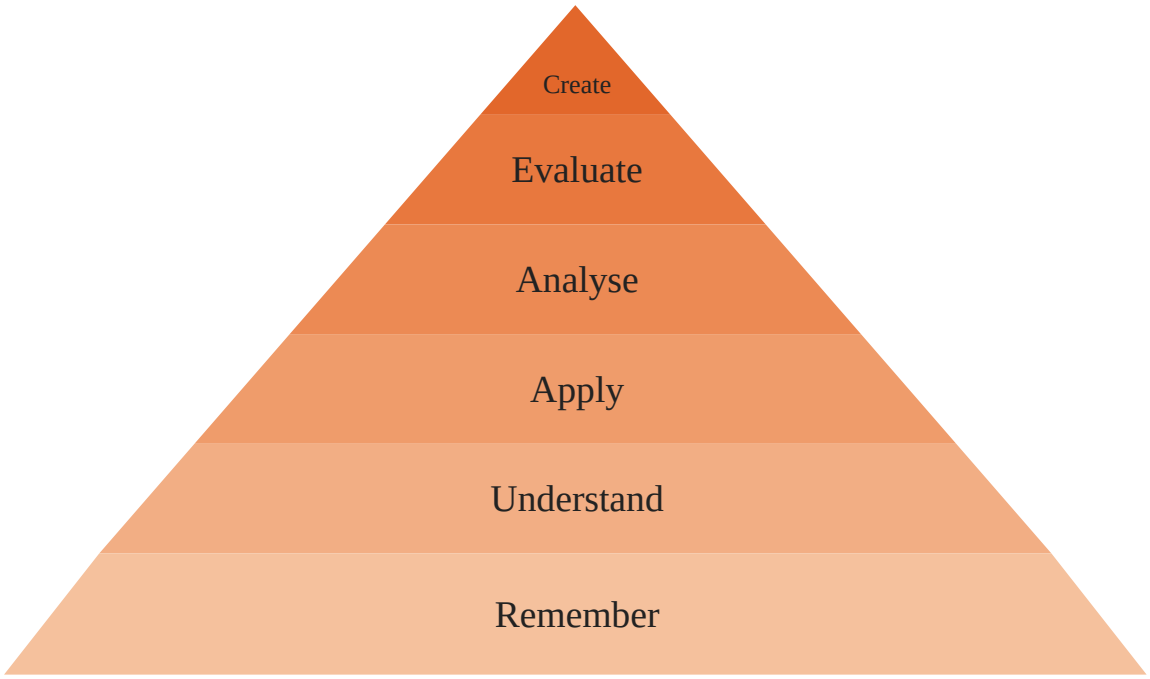


Figure 1. *Bloom's Taxonomy – levels of knowledge*

Learning outcomes

Unlike objectives, learning outcomes are oriented towards **students and their activities**. They tell us what students should demonstrate after teaching, i.e. that they have learned what was expected of them. In other words, learning outcomes define **the knowledge, skills, attitudes and values** that each student should develop.

Planning learning outcomes is important:

- to clarify (and make concrete) the purpose of learning
- so that expectations are clear to both students and teachers.

Learning outcomes should be:

- Aligned with teaching (objectives, tasks, content, methods, etc.)
- Operationalised, concrete
- Clear, precise
- Varied
- Measurable

Let us now return to Bloom's Taxonomy. As mentioned, Bloom's Taxonomy can help teachers clearly define learning outcomes, i.e. answer the question: *what do I want or expect students to learn by the end of the lesson?* Table 1 presents action verbs you can use when defining learning outcomes, taking into account the various levels of knowledge.

Table 1. *List of verbs to use when defining learning outcomes*

Levels of knowledge	Key learning outcomes (describe the student's activity)
Knowledge	Define, list, describe, compare, repeat, order, distinguish, memorise
Comprehension	Recognise, appreciate, summarise, identify, explain, classify
Application	Select, apply, demonstrate, perform, solve
Analysis	Analyse, evaluate, compare, differentiate, conclude
Evaluation	Appraise, decide, judge, check
Synthesis	Create, reorganise, plan, develop

Source: Good lesson preparation – a successful lesson.

Stop again and reflect!

When planning learning outcomes, which levels of knowledge do you rely on most often?

At the start of each Co-CREATE lesson, the learning outcomes are presented. Although they are usually read only by the teacher, it would be good to share them with students, so that they can be supported in their self-regulation process.

In the following section, we present the steps for defining learning outcomes. They should contain the following elements:

1. **Introductory phrase** – *By the end of the teaching unit, the student will be able to / the student should…*
2. **Action verb / action** – *Identify, explain, recognise, apply…*
3. **Object of the verb** (what the student will be able to do)
4. **A phrase indicating the context** or condition in which the action will be performed

Based on the example presented, it is clear that when defining learning outcomes, we need to be **student-centred**. In this way, the focus shifts from the content itself to what the student should be able to do during (and after) the learning process. The next important step is to define learning outcomes with **an action verb**. After defining the action verb (see the table of verbs based on Bloom's Taxonomy), we must also define **the object of the verb**. The object defines what the student will be able to do (for example, what they will identify or explain). And the last step is **the context**, i.e. the conditions under which the action will be performed.

Exercise – evaluating and correcting learning outcomes

Below are several examples of learning outcomes. Consider whether each one is well formulated. If not, think about which element is missing (the action verb, the object or the context) and propose a corrected version.

Example 1: "The student understands how a microcontroller works."

Example 2: "The student knows how to programme in Python."

Example 3: "The student will be able to solve problems related to electrical circuits."

✔The students' position

Students differ from one another, among other things, in prior knowledge, interests, motivation and learning styles. When planning teaching, it is important to bear in mind differences such as:

- the number of students in the class
- the age of the students
- the students' prior knowledge
- the relevance of the content to the students
- their motivation and interests
- different learning styles
- the students' cultural backgrounds

Questions for reflection:

How do you get to know your students' interests?

✔Teaching content

Teaching content is defined by the curriculum and comprises a set of facts, concepts and principles that students should acquire in a particular subject and school year. Based on the prescribed content, the teacher plans the sequence and the way of covering the teaching units, taking into account students' needs, developmental characteristics, interests, etc.

TYPES OF PLANS IN THE TEACHER'S WORK

Global plan

Global planning is done by the teacher before the start of the school year and involves drawing up an annual work plan that includes:

- the scheduling of teaching topics

- the number of lessons per topic
- the number of lessons for teaching, consolidation and assessment

The global plan forms the basis of all teaching work throughout the year. It gives the teacher an overview of the content, allows teaching materials to be prepared in good time and ensures a balanced distribution of the material. It also facilitates coordination with other teachers and alignment with the school calendar, thus contributing to the systematic organisation of the teaching process.

Operational plan

This covers the didactic-methodological breakdown of topics into teaching units. The teacher plans operationally for a month, topic, area or module.

The operational plan may include:

- the names of the teaching units and their scheduling within the topic
- the type of lesson
- the forms of work
- the methods
- innovations
- (self-)assessment methods

The operational plan bridges global planning and the concrete delivery of teaching. It gives the teacher a clear picture of the sequence of teaching units, allows various methods and forms of work to be planned in good time and supports the introduction of innovations in teaching. Thanks to the operational plan, the teacher can monitor the achievement of learning outcomes at the level of a topic or area and respond in good time if the pace or approach needs to be adjusted.

Lesson preparation / lesson plan

This refers to the preparation of a specific lesson. At this stage, the teacher precisely defines the course of the lesson, the objectives and learning outcomes, the teacher's and students' activities, the tasks and the assessment methods.

Planning a lesson involves linking the following elements into a coherent whole:

- objective(s) and tasks
- learning outcomes
- content
- teaching methods
- course of the lesson
- teaching resources
- student activities

- methods of assessing knowledge
- logistical support (teaching materials, space, seating arrangement)

Lesson preparation is the most concrete and operational form of teaching planning. It allows the teacher to deliver each lesson in an intentional, focused and effective way. A well-designed lesson plan ensures that all activities are aligned with the learning outcomes, that teaching resources and materials are prepared in advance and that students remain actively engaged throughout the lesson. Lesson preparation also serves as a document that the teacher can review and improve based on the experience of previous deliveries, continuously raising the quality of teaching.

PRACTICAL APPLICATION – RECOMMENDATIONS FOR TEACHERS

Recommendations for teachers:

- **Plan a variety of learning activities and teaching methods**[4] – a diversity of methods (for example, discussion, working with texts) contributes to greater student engagement.
- **Define learning outcomes that indicate what students should know by the end of the lesson** – use action verbs that describe the student's expected performance (for example: explain a concept, list characteristics).
- **Lesson planning should also start from students' prior knowledge, needs, learning styles and interests** – relate the new material to what students already know and to their interests and needs.
- **Plan tasks with different levels of complexity** — in this way, each student can progress according to their abilities and can work at different levels of knowledge.
- **Use various starting points when planning the teaching process** – one of the starting points for planning the teaching process can also be the results of evaluating teaching.

CONCLUSION

Remember:

- Planning, delivery and evaluation are interconnected and interdependent, which is why it is important that objectives, content, methods and ways of evaluating teaching are aligned.
- Planning teaching concerns planning students' activities, not just the teacher's activities.
- In teaching, it is important to focus not only on results, but also on the process.

[4] You can read more about teaching methods in the next chapter.

- Planning teaching does not mean there is no flexibility in the teacher's work.

QUESTIONS FOR REFLECTION

1. Where do you start when planning your teaching work – content, objectives, learning outcomes, students' needs?
2. How do you define the objectives and learning outcomes of teaching?
3. Which of the factors mentioned do you take into account when planning teaching?
4. Which levels of student knowledge do you develop through your teaching?

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Teaching methods

TEACHING METHODS

LEARNING OUTCOMES

The teacher will be able to:

- Adapt methods and forms of work (whole-class, group, individual work) to the objectives, learning outcomes and content of the lesson
- Identify the factors that determine the choice of teaching methods
- Recognise different types of methods
- Distinguish between teaching methods and social forms of organising teaching/forms of work

KEY CONCEPTS

- Teaching methods
  - Monological (lecture) method
  - Dialogical method
  - Working with texts
  - Demonstration
  - Text-based method
- Forms of work/social forms of organising teaching
  - Whole-class teaching
  - Pair work
  - Group work
  - Individual work

INTRODUCTION

In his first lesson, teacher Marko planned to use the lecture method. During the lesson, the teacher explains the material to the students in detail. The students listen, take notes in their notebooks and answer the questions the teacher asks along the way. At the end of the lesson, he asks the students whether everything was clear.

After this lesson, teacher Marko had a lesson with another class. For this lesson, he planned to use a different teaching method for the same teaching unit. In the second lesson, the teacher starts with a question. The students discuss in groups, analyse examples, draw conclusions and then systematise their knowledge together with the teacher. Some draw diagrams, others ask follow-up questions and others relate the material to previous topics.

Questions for reflection:

Which of Marko's lessons is more likely to promote effective learning?

Which teaching methods are most effective and why?

Which teaching methods do you usually use in your teaching practice?

Is it possible to combine several teaching methods and forms of work in a single lesson?

WHAT ARE TEACHING METHODS?

A method is a procedure or action of the teacher or the student through which students acquire certain knowledge and skills and develop certain abilities.

A teaching method is a procedure applied to achieve a particular goal. When we talk about the purpose of teaching methods, they should ensure student learning, i.e. contribute to achieving the objectives and learning outcomes (helping students develop different types and levels of knowledge, abilities, attitudes towards problems and attitudes towards their own knowledge and learning), but also to students' holistic, and not only cognitive, development. In the previous chapter, we saw that one of the starting points for planning teaching can be the aims of education, as well as the objectives of the different subjects. In this sense, the aims of education and the objectives of a particular subject can be achieved through the application of one of the teaching/learning methods.

What can the choice of methods depend on?

As we stressed earlier, planning is shaped by various factors, so we cannot view the choice of methods in isolation from the other elements of the teaching process (Figure 1).

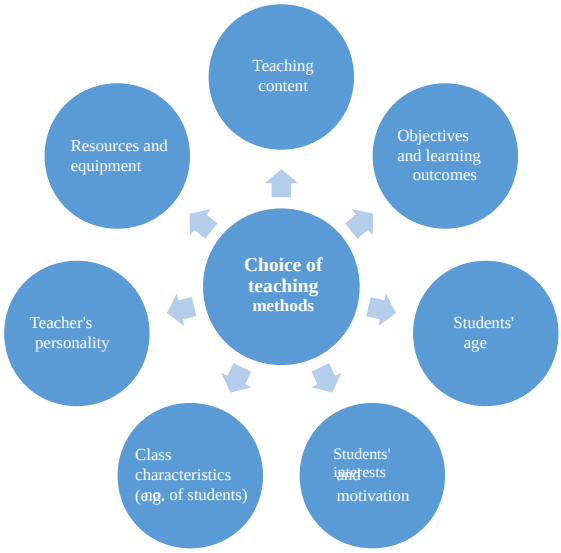

Figure 1. *The relationship between teaching methods and the other elements of the teaching process*

The choice of teaching methods depends on several factors:

- **Objectives and learning outcomes** – the teaching method should be aligned with what we want to achieve at the end of the teaching unit.
- **Teaching content** – the choice of method is influenced by the content of the teaching unit; for example, for certain units, the method of working with texts is more suitable than the dialogical method.
- **Students' age** – when choosing teaching methods, students' age and developmental characteristics should be taken into account.
- **Students' interests and motivation** – when choosing teaching methods, students' interests should be taken into account, as well as the fact that teaching methods should contribute to student engagement.
- **Characteristics of the class** (number of students) – when choosing a teaching method, the number of students in the class and the relationships between them should be taken into account; for example, for some classes the debate method is more suitable, while for others it sometimes is not.

TYPES OF METHODS

Various teaching methods and combinations of them can be used in the teaching process.

- ✔ Oral presentation method/monological method (oral presentation – lecture, description, explanation)
- ✔ Conversation method/dialogical method (discussion, debate, asking questions)
- ✔ Reading and working with texts method (written work, graphic work, use of textbooks and wider literature, reports)

- ✔ Demonstration method (presenting models, diagrams, sketches, presentations, films)

- ✔ Practical and laboratory work (laboratory work, experimental work, various types of practical exercises, workshops)
- ✔ Problem solving (heuristic approach – guiding students through discovery processes when solving problems, various playful activities – creative, artistic, dramatic)

- ✔ Student research work
- ✔ Illustrative work method
- ✔ Written work method

➤ For **theoretical and conceptual topics** (for example, introducing new definitions or historical events), the most suitable is the **oral presentation method/monological method** (lecture, explanation, description), as it allows the teacher to present new content clearly and systematically. On the other hand, purely practical methods, such as laboratory work, would not be suitable at this stage, since students first need to build a theoretical foundation before moving on to application.

➤ For **complex, problem-based topics** (for example, solving mathematical problems, analysing social phenomena, ethical dilemmas), the most suitable are the **problem-solving method** (heuristic approach) and **research work**, as they lead students through discovery processes and encourage critical thinking. In this case, a simple lecture would not be sufficient on its own, as it does not actively involve students in the reasoning process.

➤ For **practical and skills-based topics** (for example, chemistry experiments, art lessons, physical education), **practical and laboratory work** and **workshops** are the most suitable choice, as they allow students to apply knowledge directly and develop specific skills. The oral presentation method on its own would not be suitable, as these topics require hands-on experience.

➤ For **topics that require critical thinking and discussion** (for example, analysis of literary works, current social issues, ethical questions), the **conversation/dialogical method** (discussion, debate) is strongly recommended, as it allows students to express their own points of view, confront different perspectives and develop argumentation skills. In this context, a one-way lecture would be limiting and counterproductive.

➤ For **topics involving visual or multimedia content** (for example, geography, biology, history, art), the **demonstration method** (presentations, films, models, diagrams) is particularly effective, as it makes abstract content more concrete and easier to understand.

➤ For **topics that require summarising and synthesising knowledge** (for example, revision lessons, end-of-unit summaries), the **method of reading and working with texts** combined

with **written work** can be very effective, as it encourages students to organise and consolidate what they have learned.

Source: Good lesson preparation – a successful lesson.

FORMS OF ORGANISING TEACHING

Although an equals sign is often placed between teaching methods and forms of social organisation, they are **two different didactic categories**. The teaching method answers the question *of the ways in which the learning process takes place*, while the social forms of organising teaching concern the way *students are organised*. Teaching methods and forms of social organisation can be combined with each other; for example, students can be divided into groups and the learning process can take place through the discussion/debate method.

In addition to teaching methods, forms of work are also an important segment of the teaching process. The social forms of organising teaching concern **the way students are grouped** and **the way interaction is organised between the teacher and students**, **as well as among the students themselves**, during the teaching process.

We can speak of the following forms of work/social forms of organising teaching:

➔ **Frontal work** (the teacher works with all students at the same time)

Frontal work is most suitable when **introducing new content** to all students at the same time, giving instructions, demonstrating a procedure or summarising a lesson. It is efficient for conveying information to a large group at once, but its main limitation is that it places students in the position of passive recipients rather than active participants. Research suggests that prolonged frontal teaching, without breaks or interactive elements, leads to a decrease in attention and retention after about 10 to 15 minutes.

➔ **Group work** (students are divided into smaller groups)

Group work proves most effective when students work on **open-ended problem-solving tasks, projects, case studies or discussions** that benefit from multiple perspectives and collaborative effort. Studies on cooperative learning have consistently shown that well-structured group work improves not only academic results, but also social skills, motivation and a sense of belonging. However, for group work to be effective, tasks must be carefully designed so that each member has a clear role and contribution — otherwise, the risk of unequal participation is high.

➔ **Pair work** (two students work on a common task)

Pair work is particularly effective for **shorter collaborative tasks**, such as peer review, dialogue practice (especially in language learning), mutual explanation of concepts or quick problem-solving exercises. It ensures that both

students are actively involved, which is sometimes harder to achieve in larger groups.

Individual work (each student works independently, at their own pace, according to their abilities)

Individual work is most suitable for tasks in which **students need to work at their own pace**, reflect independently, apply knowledge or demonstrate their individual understanding. It is especially important in assessment contexts, but also valuable in practice phases in which students consolidate new knowledge on their own. Individual work also respects differences in learning speed and cognitive style.

PRACTICAL APPLICATION – RECOMMENDATIONS FOR TEACHERS

- **Align the teaching method with the objectives and learning outcomes of the lesson** – bear in mind that the teaching method is not an end in itself; choose it based on what students should know. Depending on the objectives and learning outcomes of the lesson, you can choose suitable methods — for example, if students are being introduced to new material, the lecture method will be more suitable than debate.

- **Take into account students' age and prior knowledge** – the same method does not produce the same results in different years/classes. When choosing methods, pay attention to students' developmental characteristics, their prior knowledge, their interests and their motivation.
- **Combine different methods in a single lesson** – there is no ideal or only correct method. Methods rarely appear in their pure form; on the contrary, they intertwine. For example, you can combine working with texts and discussion in the same lesson. This is also stimulating for students with different learning styles and intelligences (see the chapters on these two topics).
- **Combine teaching methods and different forms of work** – in the same lesson, you can use/combine different teaching methods and different forms of work. For example, you can use debate within group work, or students' individual work with the text-work method.
- **Align methods with the teaching content** – certain content is easier to cover through certain methods (for example, certain social topics can be analysed through discussion/ debate, while in teaching literature, working with texts is suitable).

CONCLUSION

Remember:

- Methods rarely appear in their pure form; on the contrary, they intertwine, and it is possible to use/combine several teaching methods in a single lesson.
- Methods concern not only what the teacher does, but also what the students do.

- When planning, bear in mind what the learning outcomes are and then choose the method that leads to achieving them.
- Align methods with students' needs (for example, take into account the class structure, relationships, students' interests, learning styles, etc.).

- It is possible to combine different forms of organisation and different methods in the same lesson.

QUESTIONS FOR REFLECTION

1. Which teaching method do you use most often and why?
2. How do you choose teaching methods for a lesson (what do you base your choice on)?
3. Which methods do you combine most often?
4. How do you evaluate the effectiveness of the method applied?
5. Which social forms of organising lessons do you use most often?

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Evaluation

EVALUATION

LEARNING OUTCOMES

The teacher will be able to:

- Identify different types of assessment
- Recognise important steps in the monitoring and assessment process
- Define clear assessment criteria
- Distinguish between formative and summative assessment
- Create an assessment rubric

KEY CONCEPTS

- Evaluation of teaching
- Monitoring and assessment of students
- Assessment methods
- Assessment rubrics
- Assessment criteria
- Summative assessment
- Formative assessment

INTRODUCTION

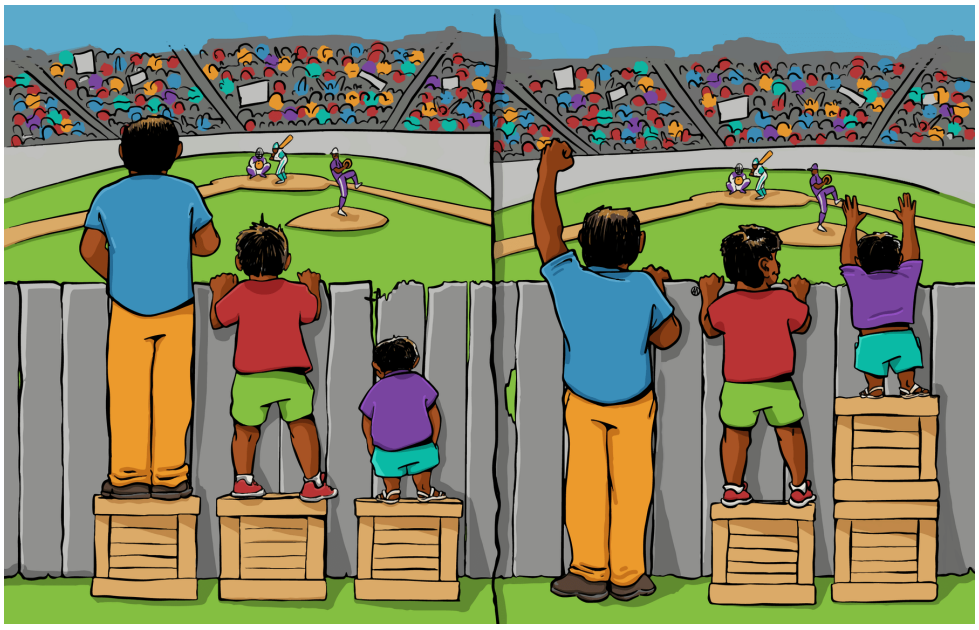

Figure 1. Inclusive values 3 (equality and equity) Source: eracoalition.org – Dissecting the famous equity/equality illustration by Angus Maguire

Questions for reflection:

Do assessment criteria have to be the same for all students?

What is fair assessment?

What is equity and what is equality in the context of assessment?

EVALUATION OF TEACHING, MONITORING AND ASSESSMENT OF STUDENTS

In the previous chapters, we addressed the planning and delivery of teaching; in this chapter, we will address evaluation. Evaluation is part of the teaching process; it encompasses the **study** (monitoring and analysis) of teaching and serves to understand **the process** and **the results** of teaching. In this sense, we can speak of two levels of evaluation: monitoring and assessment of students, and evaluation of teaching.

Monitoring and assessment of students

Monitoring and assessment are part of the teaching process and are not an isolated activity. When we talk about student assessment, we speak of it as an aspect of evaluation that allows us to follow students' progress and results, the effectiveness of teaching and the teacher themselves. Assessment is a process consisting of planning, following the course of teaching and learning, recording data on students' progress, giving students feedback and evaluating the teaching carried out.

What does assessment planning include?

Assessment planning is an integral part of lesson preparation and requires the teacher to determine – with the same care with which they plan objectives and activities – what will be assessed, how and when (Figure 2).



Figure 2. *Assessment planning cycle*

When we talk about planning monitoring and assessment, it is important to answer two questions:

- ✔ WHAT will we monitor and assess?
- ✔ HOW will we monitor and assess?

WHAT can we monitor and assess?

- Students' results
- Effort, dedication and interest
- Students' progress

HOW can we monitor and assess?

✔ ***Plan activities***

In the process of monitoring and assessment, plan activities:

- through which students and teachers follow progress and obtain data on development,
- through which students understand the teaching objectives and assessment criteria and take part in creating them,
- through which students can receive and understand feedback and plan and monitor their own learning.

✔ ***Plan the assessment methods***

Assessment can be carried out through:

- Specific formal tests
  - oral
  - written
- Practical tasks and projects
- Various teaching activities serving monitoring and assessment (and self-assessment)
- Various informal assessment activities

Questions for reflection:

Can you list the advantages and disadvantages of oral and written tests?

✔ ***Plan the ways of giving feedback and the grading format***

How can you give students feedback?

- Independently
- With an explanation of the numerical grade
- In the form of a descriptive assessment

✔ ***Plan the criteria***

Some rules for defining assessment criteria:

- Assessment criteria are planned as part of planning the activities and should be closely related to the learning objectives, the learning outcomes and the logic of the activity we want to assess.
- It is desirable for them to relate very carefully and precisely to the structure of students' performance.
- It is also desirable for them to be operationalised according to the level of performance – explicitly expressing the performance scale and the way it is assessed.
- It is desirable for them to be formulated simply, so that they are understandable for students.
- Students must know them before starting any activity.

ASSESSMENT METHODS

In school practice, assessment is often used to grade students. When we talk about forms of assessment, we most often mean oral and written assessment.

Oral assessment can be carried out through various approaches:

- Conversation
- Students' oral presentations on various topics

- Public presentation of the results of individual and/or group work
- Discussions
- Oral questioning of the whole group or class through short questions and answers

Written assessment is a form of assessment in which students answer in writing, and the questions may be given by the teacher orally or in writing. When applying this type of assessment, the following are used:

- Dictations
- Short written answers
- Thematic written assignments
- Knowledge tests

Tests as a form of student assessment

Through tests we can check students' knowledge, skills and abilities, using achievement tests/ knowledge tests for this purpose. The tests teachers use in school practice are most often non-standardised tests, namely: series of objective-type items and informal knowledge tests constructed by the teachers themselves.

A good knowledge test should be:

- valid and relevant
- objective
- discriminating

Constructing test items

When formulating and constructing test items, we should take into account:

- the material assessed by the item
- the thinking processes applied to the content

What forms can the items of a knowledge test take?

- **Extended-response items** – questions should be clear and precise, and students should know exactly what is being graded; students should also be informed of the expected length of the answer.
- **Completion items (fill in the blanks)** – students are expected to complete sentences from which certain words have been omitted. Bear in mind that a sentence should not have more than two blanks.
- **Binary-choice items (true/false)** – students are expected to choose one of two answers given. When creating these items, avoid double negatives and words such as: always, nothing, may, must.

- **Multiple-choice items** – students are expected to choose one or more correct answers. When formulating these questions, no fewer than three and no more than seven answer options should be offered. It is very important that the answers offered are of similar length.
- **Matching and ordering items** – in these items students are expected, for example, to order a series of data, rank something or match pairs according to certain principles.

Important notes on constructing tests:

- Combine different types/formats of items
- Avoid unclear or vague words
- Avoid repeating sentences from the textbook word for word in the test
- No ambiguities and no "trick" questions
- There should be no relationship between two items such that solving one makes it easier to solve the other
- Make sure it is not only the extended-response items that require higher levels of thinking!

Grading guidelines

- Questions that require lower cognitive levels should be worth fewer points.
- Students should be able to obtain a pass mark even if they demonstrate only memorisation (the first level according to Bloom).
- Students can only obtain the highest grade if they demonstrate higher cognitive processes.
- It would be good for students to know in advance, roughly, how many points each item is worth.
- The marking criteria should be prepared before grading, but you can change them if you notice that too many students had very poor or very good results on the test.
- For extended-response items, you may also need a mini-rubric.

Assessment rubrics

Assessment rubrics can be seen as a type of rating scale, usually designed in the form of a table that crosses assessment criteria with levels of performance. Assessment rubrics are very important for teachers, and their use makes the assessment process transparent and consistent. In addition, they allow teachers to reflect on what exactly they are assessing in their students, what criteria guide them and in what way.

What can be assessed with a rubric?

- written work (for example, opinion pieces, research papers, portfolios)
- artistic and graphic work
- students' presentations and oral talks

How to create an assessment rubric?

→ **Review the objectives** – it is important to review the objectives you intend to achieve through the task to be assessed. It is important to clearly formulate the learning outcomes – what you want students to demonstrate.

→ **Identify the assessment criteria you will use to assess the task.** Assessment criteria may relate to the objectives/learning outcomes, to general characteristics of the process of carrying out the task and of the product itself (for example, systematicity, consistency), as well as to other aspects of the student's work on the task (for example, effort invested, contribution to group work, etc.).

→ **Define the number and names of the levels of the performance scale** you will use to describe students' success in carrying out the task, taking into account each of the criteria above. As for the number of levels, 3 to 4 is ideal (but no more than five). It is important that the same scale is used for all criteria, but also that the level names suit the nature of all the criteria. When defining the level names, make sure they are formulated positively – that is, use positive terms rather than terms that may sound demotivating to students (so avoid terms such as: poor, insufficient, unacceptable). Instead, use terms such as:

- High level. Intermediate level. Basic level.
- Proficient. Developing. Emerging.

→ **Formulate performance descriptions for each assessment criterion at each level.** For each criterion in the rubric, you should add, in the corresponding "cell", a concrete description of the student's performance for each level – that is, the indicators that show that a particular level of performance has been reached in the task. In this step, it is important to try to "nuance" how you will distinguish students' levels of success for each of the criteria identified in the second step. These descriptions should therefore be clear, understandable and precise.

→ **Determine the weight of each criterion in the final grade and how many points each level of performance is worth in the different criteria.** This step allows you to give more importance to some criteria than to others. In this regard, it is also important to define how you will score each new level of performance in each assessment criterion. Adjacent levels should, as a rule, be an equal "distance" apart in terms of points (for example, the high level is worth 3 points, the intermediate 2 and the basic 1 point; or the high level is worth 1 point, the intermediate 0.5 points and the low 0 points). It is not advisable for some criteria to be worth a particularly high number of points compared with others, as this creates a potentially

large gap in points between adjacent levels of that criterion, leading to drastic differences in the student's final score (for example, if a criterion is worth 10 points, with the high level worth 10, the intermediate 5 and the low 0).

→ **Determine how the final grade for the task will be formed.** In this step, it is important to organise the scoring of the rubric so that the task is worth a certain total number of points, then distributed across the criteria and levels, with the grade calculated from the points according to a scale. If grades range from 1 to 5 and the task is worth 10 points, the scale could be:

- 0–2 points = level 1
- 2–3 points = level 2
- 4–6 points = level 3
- 7–8 points = level 4
- 9–10 points = level 5

→ **Assess several representative samples of work to check the consistency of the rubric** – after creating the rubric, try assessing some students' work to see whether you have left out any criteria and whether the rubric, as formulated, allows you to distinguish different levels of success. Based on this step, you can revise your rubric.

→ **Add a final column for comments.** This column is very important, especially if you use it to give students feedback.

Table 1. *Example of a rubric (text on the importance of water for life)*

Criteria	**Performance levels**			**Comments**
	Successful	**Partly successful**	**Needs more work**	
Consistency of argumentation	Throughout the text, the argumentation is consistent, creating a coherent picture of why water is important for life (2 points)	Arguments are presented, but are inconsistent in places (1 point)	No consistency in argumentation is evident in the text (0 points)	
Use of sources	Refers to three or more different sources of information on the importance of water: textbook, encyclopaedia, magazine, TV programme, internet… (1 point)	The text refers to more than one but fewer than three sources of information (0.5 points)	There are no direct references to sources of information in the text, or only one source is cited (0 points)	

Criteria	Performance levels			Comments
	Successful	**Partly successful**	**Needs more work**	
Structure of the text	The text has the required structure (introduction, main body, conclusion) (1 point)	The text lacks an adequate introduction or conclusion (0.5 points)	The text is not, on the whole, adequately structured (0 points)	
Technical formatting of the text	Meets all three requirements: (1) the font is consistent throughout the text, (2) the text is justified, (3) bold and italics are used exclusively to highlight key ideas (1 point)	One or two requirements relating to the technical formatting of the text are met (0.5 points)	None of the requirements are met (0 points)	

Types of assessment

In relation to the functions of assessment, we speak of:

- ❖ formative assessment
- ❖ summative assessment.

Formative assessment takes place **during** the teaching process itself. When we speak of the purpose of formative assessment, we mean **guiding the teacher's planning** and **helping students identify the areas they should work on.** Thus, based on it, the teacher plans the next activities and makes decisions about how to plan the following lessons.

Formative assessment answers the question: "What has the student already achieved?", so that the question of what to do next and how can be answered.

Applying formative assessment in practice would mean that you **follow students' work**, ask them **how** they do something and **why** they work that way, **support** them in these activities and **suggest** certain changes/guidance in their work. In this way, you send students the message that you are following their work and that you are interested in their work and progress. Furthermore, you **take part together with the students** in building the learning process. In the formative assessment strategy, assessment includes

informative, guiding and evaluative statements about students' progress, their results and their learning needs.

Unlike formative assessment, which takes place during teaching and helps shape instruction, summative assessment is carried out **at the end of a certain period**, for example, at the end of a teaching unit, a semester, etc. Summative assessment gives us a picture of how much students have learned up to that point, i.e. its purpose is to inform students and teachers **about the level of performance reached.**

> **Summative assessment answers the question: how much has the student learned in a given period and to what extent do they master the content set out in the curriculum?**

Source: Assessment for student development – a handbook for teachers.

EVALUATION OF TEACHING

When can we evaluate teaching?

- during the planning of teaching
- during teaching itself
- after teaching has taken place

Why is (self-)evaluation important?

- So that we understand what is happening in the teaching process
- So that we can plan and develop teaching and adapt it to students' needs and abilities and to the context
- So that we can achieve the objectives set
- So that we develop as teachers
- So that we can change and develop teaching practice

In what ways can we evaluate the teaching process?

- **Questionnaires, evaluation forms, scales** – students and teachers can fill in various questionnaires/scales that can be used to evaluate the quality of teaching, the clarity of the teacher's explanations, the classroom climate, etc.
- **Products of practical and other tasks** – by analysing students' work, it is possible to evaluate the effectiveness of teaching, as well as whether and to what extent students have acquired certain knowledge.
- **Knowledge tests** – students' test results indicate whether and to what extent students master the planned material, which can be one of the indicators of the effectiveness of teaching.
- **Student portfolio** – students' portfolios and their work over a certain period can be a way of following students' progress and

development and, among other things, an indicator of how teaching can stimulate students' learning, creativity and independence.

- **Teacher portfolio** – the teacher's portfolio allows them to document their own practice and is a form of self-evaluation and a basis for professional development.

- **Personal notes during and after the lesson** – teachers can take notes on various teaching situations and student activities, and these notes can be very meaningful for the teacher's self-reflection.

Bear in mind that this list is not exhaustive…

Questions for reflection:

In what way do you evaluate your teaching?

GUIDELINES FOR TEACHERS

- **Evaluate teaching continuously** – bear in mind that evaluating teaching is not a one-off activity; carry it out during planning and during/after delivery. In this process, you can use various instruments: evaluation questionnaires, personal notes, portfolios.

- **Use the results of evaluation as a starting point for planning the teaching process** – the data you obtain from evaluating teaching can be very meaningful for future planning.

- **Plan student assessment** – assessment is an integral part of the teaching process and not an "add-on". When planning the teaching process, plan the assessment methods and criteria.
- **Use various methods of monitoring and assessment** – when assessing students, use various methods of monitoring and assessment. In addition to formal oral/written tests, follow students' effort and progress.
- **Define clear and understandable assessment criteria** – assessment criteria should be precise and aligned with the other elements of the teaching process. Formulate them so that they are clear to students and communicate them before the activity, not after giving the grade.
- **Pay attention to feedback** – bear in mind that, in addition to communicating the grade, students should also receive feedback on how much they have progressed, what they have achieved and what the next steps are. In doing so, avoid merely evaluative comments, such as good/bad, without further guidance.

CONCLUSION

Remember:

- Evaluation is part of the teaching process and includes the study (monitoring and analysis) of teaching, with the aim of understanding and improving the process and results of teaching/learning.
- Monitoring and assessment of students (emphasis on the formative nature of assessment, following the process, using less formal forms of assessment…).
- Grading refers to the assessment of students' work (most often when it is formal, i.e. involves giving a mark).

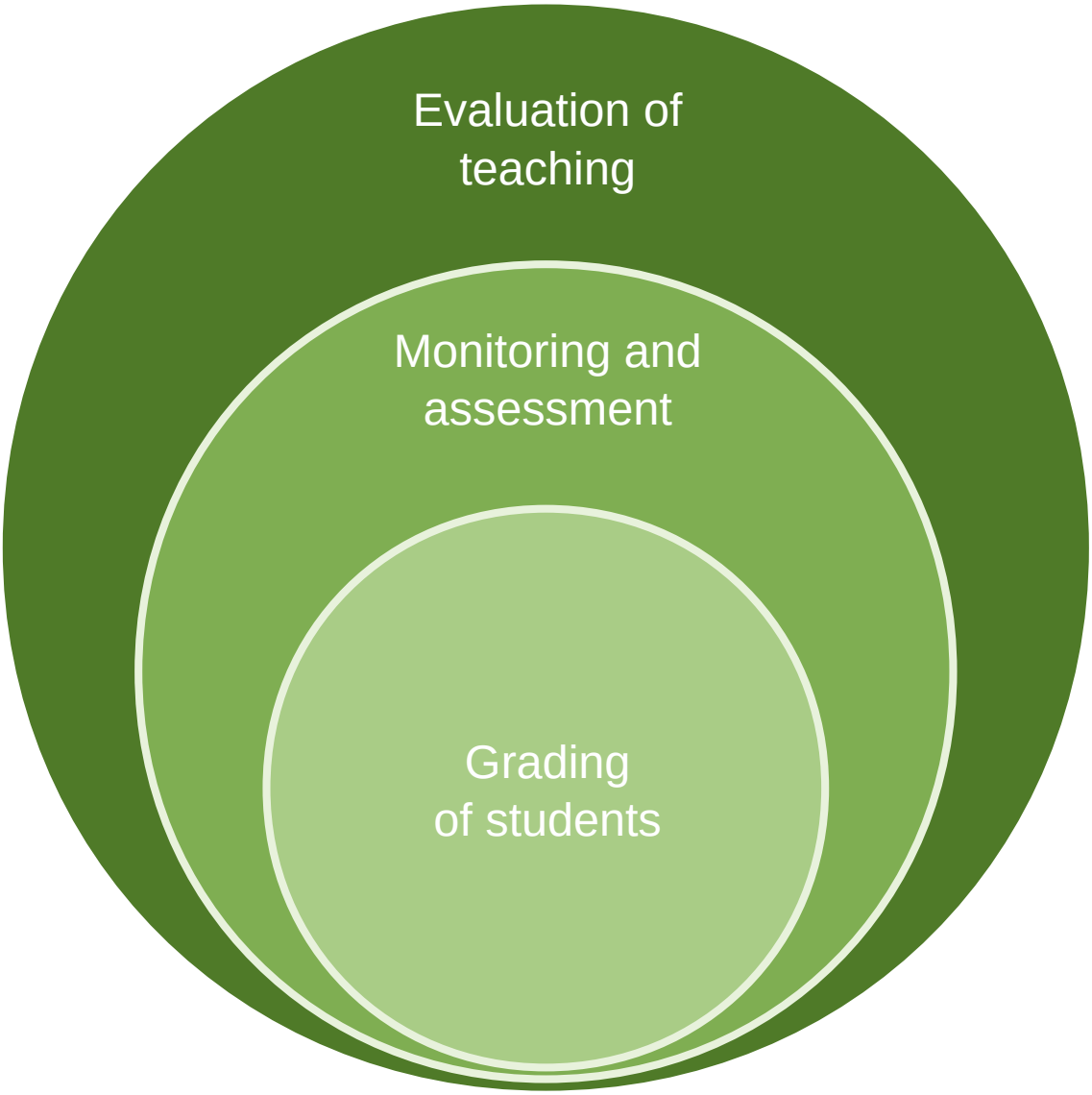

Figure 3. *The relationship between evaluation of teaching, monitoring and grading*

QUESTIONS FOR REFLECTION

1. In what ways do you evaluate/reflect on your own practice?
2. In what ways do you use evaluation results in lesson planning?
3. What type of assessment do you use most often?
4. How often do you use descriptive assessment in your practice?

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Collaboration

COLLABORATION

LEARNING OUTCOMES

The teacher will be able to:

- Distinguish between collaborative problem solving and cooperative learning
- List the basic principles of collaborative problem solving
- Understand the PEER collaboration model, i.e. the model based on four elements of effective collaboration in problem solving
- Design and follow the implementation of collaborative problem solving in the classroom, using the PEER and OECD models

KEYWORDS

- Collaborative problem solving
- Types of collaborative problem-solving tasks
- PEER model
    - Personality
    - Emotional intelligence
    - Exchange
    - Resources

INTRODUCTION

Teacher Marko planned to divide the students into groups during the lesson. Each group member received their own task: one student searched for information, another made a diagram and a third wrote the conclusion. Each worked on their own task and was responsible for it. At the end, they put the parts together into a whole. The work looked neat and everything seemed like collaboration. However, during the presentation, teacher Marko noticed something unusual. Ana did not understand the diagram Nikola had made, because she had not seen it being built. Nikola did not know why that conclusion had been written, because he had not taken part in the thinking process. Each had done their own work – and stayed in their own corner.

In the next lesson, teacher Marko wanted the students to work in groups again. This time, however, he did not hand out tasks; instead, he told them to work together to figure out how to answer a problem. At first there was noise and disagreement. Jelena proposed one approach, Nikola another. Ana asked a question to which no one had a ready answer. They sat down and thought together. They took turns proposing solutions, correcting each other and reflecting on how they had arrived at those answers.

Questions for reflection:

Do you know the difference between collaborative problem solving and cooperation?

COLLABORATIVE PROBLEM SOLVING

Collaborative problem solving is a strategy in which students work together, in groups, to solve various problems and explore concepts and ideas. It is based on peer exchange, interaction and the constructive negotiation of power relations within the group. In this context, through group work, students collaborate to acquire certain knowledge and skills together, respecting each person's contribution to achieving the collectively defined goal.

Unlike cooperative learning, which focuses on the effects of group interaction on individual learning – where students divide the tasks and each is responsible for "one" part –, collaborative problem solving focuses on the **joint construction of meaning and the creation of a shared learning space.** Applying collaborative problem solving is extremely important for students, as it allows them to defend **their points of view, shape ideas and listen to other perspectives.** Thus, in these processes we do not see students as passive recipients of information, but as **active participants in constructing knowledge through interaction with others.**

It involves students' active participation in the joint construction of knowledge through interaction, dialogue and mutual support in small groups.

With this definition of collaborative problem solving in mind, we identify the following key elements:

- ✔ Positive interdependence
- ✔ Face-to-face promotive interaction
- ✔ Individual and group accountability
- ✔ Collaborative skills
- ✔ Joint evaluation of work

Similarly, in the OECD PISA framework (OECD, 2017), collaborative problem solving is defined as the capacity of students to engage in a process in which two or more people **share understanding, coordinate efforts and combine knowledge and skills to reach a solution**.

TYPES OF COLLABORATIVE PROBLEM-SOLVING TASKS

→ Group decision-making tasks

This type of task requires students to present arguments, negotiate and reach a joint solution/ decision. These tasks are very important because they put the focus on the process of reaching a solution rather than on the solution or answer itself. They also require students to listen to their classmates' opinions, which can often be contradictory. In this way, the development of collaboration, negotiation and critical thinking is promoted.

Fishbowl discussion

A technique in which a small group of students sits in a circle ("in the fishbowl") and holds a discussion/debate on a topic, while the rest of the class sits around them, in a larger circle, and only listens, without taking part – until space opens up for them to join. This technique is particularly good for group decision-making tasks, because it slows the debate down, prevents everyone from talking at the same time and allows arguments to be heard and considered more carefully.

Steps:

1. Arrange two circles of chairs (inner + outer), leaving 1–2 empty chairs in the inner circle.
2. Write a question on the board (for example, "How should AI be used ethically in learning?").
3. The inner circle discusses and negotiates the decision; the outer circle only listens (and may take notes on the arguments).
4. Anyone who wants to take part sits in an empty chair.
5. At the end, the whole class formulates the final decision/conclusion together.

→ Group coordination tasks

This type of task involves coordinating the actions of team members who each hold different and interdependent information. These tasks require active sharing, asking questions and integrating different sources of knowledge. In this way, the skill of building a shared understanding develops. A technique you can use in your classroom is the *jigsaw* method.

Jigsaw

A technique in which a topic is divided into several subtopics. Each student becomes an "expert" on one part, in a separate group, and then returns to their home team to pass on their knowledge to the others, so that the team can put together the complete picture.

Steps:

- The class is divided into "home groups".

- The material is divided into as many topics/subtopics as there are members in each group.
- Each student in the home group receives part of the material and goes to an expert group, made up of students from other home groups who have the same task.
- The expert group works together to master their part of the material and prepares how to explain it to the other members of their home group.
- Then each student returns to their home group and teaches the others their part, and the home group "puts the whole picture together".

This technique is suitable for work with small groups (five or six students).

→ Group production tasks

This type of task requires the group/team to work together to create a specific product, such as: a design, a report, a presentation, a model or a solution. The focus is on dividing the work, coordinating contributions and integrating the individual parts into a coherent whole.

Creating a poster/infographic

A technique in which the team works together to create a visual representation (poster or infographic) on a particular topic. Each member takes on a specific role – research, design, writing or illustration – and, at the end, all the parts are combined into a single coherent product.

Steps:

1. The teacher assigns a topic to each group (for example, "The water cycle", "Causes of the First World War").
2. The team distributes the roles among its members: researchers (collect key facts and information), writers (summarise the content in short, clear texts), designers (plan the layout and choose colours/fonts) and illustrators (make drawings and diagrams or find images).
3. Each member does their part individually or in pairs and then brings the result to the group.
4. The team puts all the pieces together into the poster/infographic, making sure that:
    - the information is accurate and logically organised
    - the visual style is consistent (colours, fonts, layout)
    - the final product clearly communicates the topic to an outside viewer
5. The final poster is presented to the rest of the class, with each member explaining the part they contributed.

The teacher's roles in collaborative problem solving

Although the focus of collaborative problem solving is on the students and their interaction, we present and highlight the teacher's roles below.

- Plans and combines methods and activities to engage students
- Gives clear information and instructions from the start (especially regarding communication within the group)
- Helps clear up doubts during the work process
- Guides and motivates students throughout the learning process
- Creates a pleasant and stimulating working environment

Questions for reflection:

On what basis do you form groups for collaborative learning?

Possible reflection questions for teachers to assess whether collaborative problem solving is taking place effectively in the classroom (according to the OECD framework used in the PISA study):

- ✔ Do students ask each other questions?
- ✔ Do they listen to and build on each other's contributions?
- ✔ Do students need each other's information or knowledge?
- ✔ Do they make decisions together?
- ✔ Do students distribute roles?
- ✔ Do they monitor progress?
- ✔ Do they resolve disagreements constructively?

You can also find rules for collaboration (and use them to assess students' work) in our Co-CREATE lesson on disassembling a computer.

THE PEER MODEL OF COLLABORATIVE PROBLEM SOLVING

In the following section, we share with you one of the models of collaborative problem solving. The collaborative learning model we are going to present is called the PEER model.

PEER is an acronym representing four key elements of quality collaboration:

- **P – Personality:** individual differences in personality traits influence the way each student takes part in teamwork.
- **E – Emotional Intelligence:** the ability to perceive, understand and regulate emotions – one's own and those of others – is essential for groups and for achieving collaboration.

- **E – Exchange:** collaboration requires clear rules for exchanging points of view, so as to prevent conflict.
- **R – Resources:** digital technologies and other resources can balance participation and expand the group's possibilities.

Source: Collaboration leads to solutions – a handbook for implementing the PEER model of collaborative problem solving.

In the following section, we briefly present each element of collaboration according to this model and its connection to collaborative problem solving.

Personality – how are personality and collaborative problem solving connected?

To better understand how different personality traits can influence behaviour in a group, we first need to explain what personality actually is. *Personality* is defined as a relatively stable set of patterns of thinking, feeling and behaving in which people differ from one another. According to one of the most widely accepted models in psychology, personality can be described through five fundamental dimensions, known as the "Big Five":

- ➢ *Neuroticism/emotional stability* refers to the degree of resilience to stress and the tendency towards negative emotions. People with high emotional stability stay calm even in tense situations, while people with lower emotional stability are more prone to anxiety and mood swings.
- ➢ *Extraversion* concerns openness towards others, energetic engagement and a tendency towards interaction. Highly extraverted students communicate clearly, express ideas and take the initiative, while introverted students are quieter, more reserved and more withdrawn.
- ➢ *Openness to experience* encompasses curiosity, creativity and tolerance of novelty and diversity. Highly open students bring original ideas, while lower openness is associated with a preference for tried-and-tested practices and practical approaches.
- ➢ *Agreeableness* brings together qualities such as empathy, cooperation and trust in others. Highly agreeable students are "team players", care about the group atmosphere and are approachable. By contrast, lower agreeableness may show itself in a competitive attitude or a tendency towards conflict.
- ➢ *Conscientiousness* implies organisation, diligence and responsibility. Highly conscientious students meet deadlines, take responsibility for agreed obligations and approach tasks systematically. On the other hand, lower conscientiousness may show itself in disorganisation or in putting off obligations.

It is important to understand that these dimensions are not categories into which students should be sorted, but rather continua – each of us lies somewhere between the two

extremes of each dimension. The aim is not to determine who is a "good" or "bad" collaborator, but to understand how different traits influence behaviour in a group.

There are no "bad" personality traits for teamwork. Each dimension brings strengths and challenges. The aim of collaborative learning is not to change students, but for them to learn to recognise their own traits and those of others and to respect them in collaboration. Diversity of personality profiles can be an advantage – as long as the group is aware of that diversity.

Why do we talk about emotional intelligence and collaborative problem solving?

Imagine the following situation: two students cannot agree on which idea is better. One begins to withdraw and goes quiet; the other talks louder and louder. In the end, neither idea was put into practice, but the group atmosphere was damaged. What happened? There was no lack of knowledge about the task. What was missing was the ability to perceive, use, understand and manage emotions – what psychologists call emotional intelligence.

Emotional intelligence (EI) refers to a set of cognitive abilities for processing information related to emotions. A model of emotional intelligence, developed by Mayer and Salovey, holds that emotional intelligence comprises four branches, each involving a distinct set of cognitive skills.

- ❖ **Perceiving emotions:** the ability to accurately recognise one's own and others' emotional states – from facial expressions, tone of voice, body language, etc.

- ❖ **Using emotions:** the ability to put one's emotional state to work in the service of problem solving.
- ❖ **Understanding emotions:** knowing the "logic" of emotions – why they arise, how they develop, what triggers them, etc. This branch also includes an emotional vocabulary: the ability to put a name to an emotion.
- ❖ **Managing emotions:** the ability to regulate one's own emotions and to constructively influence emotional states within a group.

Why is EI important for collaboration and for collaborative problem solving?

- ❖ It influences the group atmosphere

- ❖ It helps prevent conflicts
- ❖ It improves results

Why is the exchange of ideas through dialogue important for collaborative learning?

When we talk about achieving collaborative learning, one of the prerequisites is establishing collaborative relationships within the team. This also implies a set of specific rules:

- ❖ All team members are equal and respect each other.
- ❖ Maintain a positive atmosphere even when team members have different opinions.

- ❖ Everyone shares responsibility for the group's work.
- ❖ We help each member contribute to the group's work.
- ❖ Seek to reach decisions that everyone can support.

As we have already mentioned, collaboration is always directed towards solving problems – so we must also address the rules for solving problems in a group:

- ❖ Consider as many ideas as possible in order to choose the best one
- ❖ Justify each idea, weigh up arguments and devise solutions
- ❖ Use time wisely when working on the task
- ❖ Monitor progress and plan the next steps

Why are resources important in collaborative learning?

Resources are everything we can use and rely on to resolve a problem situation. Based on this understanding of resources, it is clear that finding solutions and achieving goals is directly related to the availability and choice of these resources.

Possible resources students can draw on during collaborative problem solving:

- ❖ material resources – equipment, teaching materials, books
- ❖ non-material resources – one's own knowledge
- ❖ social resources – other relevant people and their skills (for example, other team members, teachers, parents)
- ❖ digital resources

The next chapter focuses specifically on how digital resources can be used in collaborative problem solving.

Source: Collaboration leads to solutions – a handbook for implementing the PEER model of collaborative problem solving.

PRACTICAL APPLICATION – RECOMMENDATIONS FOR TEACHERS

- **Talk with students about differences** – raise awareness, together with students, that people may approach teamwork in different ways and that these differences are acceptable.
- **Create heterogeneous student groups** – create groups in which students have different learning styles.
- **Also pay attention to introverted students** – opportunities for inclusion can be created through the use of various methods and activities, for example, rotating roles.

- **Support conversations about emotions** – encourage students to talk about how they feel (positive and negative emotions).
- **Also include reflection on the dynamics of group work** – for example, ask students to report on what worked in the group, whether collaboration was difficult at any point and how they resolved those difficulties.
- **Clearly define the rules of communication and dialogue** – create the rules together with the students; they can be displayed during the work session.
- **Use various digital tools in collaborative problem solving** (read more about this in the next chapter).
- **Teach students to critically evaluate the information they find on the internet.**

CONCLUSION

Remember:

- **Collaborative problem solving is not the same as cooperative learning** – the fundamental difference lies in whether students construct knowledge together or merely divide up tasks.
- **Differences within a group can be an advantage rather than an obstacle** – differences in personality, working styles and learning styles can enrich the problem-solving process.
- **Collaboration is not an innate ability** – collaboration is learned and developed through various situations in which students have the opportunity and space to learn and solve problems.
- **Emotions are an integral part of collaboration** – the group atmosphere, mutual trust and emotional intelligence directly influence the quality of joint work.

- **Dialogue plays an important role in collaborative problem solving** – it is through dialogue that students jointly negotiate ideas and arrive at solutions.

- **The teacher, in collaborative problem solving, is not a mere observer** – their role is active, but different: they guide, create the conditions for quality collaboration and intervene when necessary.

QUESTIONS FOR REFLECTION

1. How often do you apply collaborative problem solving in your work?
2. How do you form groups? Do you take into account differences in students' personality traits and how these differences affect group dynamics?
3. Are there clear, jointly agreed communication rules for group work in your class?
4. Which resources (material, social, digital) do your students most often choose in collaborative work?

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CSCL – Computer-Supported Collaborative Learning

CSCL – COMPUTER-SUPPORTED COLLABORATIVE LEARNING

LEARNING OUTCOMES

The teacher will be able to:

- Explain the concept of CSCL (*Computer-Supported Collaborative Learning*)
- List the basic principles on which CSCL is based
- Identify the ways in which CSCL can be applied
- Recognise the importance of using various tools
- Understand their own role within CSCL

KEYWORDS

- CSCL (Computer-Supported Collaborative Learning)
- Interaction between students
- Online tools for collaborative problem solving
    - Collaborative writing
    - Collaborative learning and research
    - Online collaborative laboratories
    - Collaborative project management
    - Management of learning and assessment
    - Collaborative programming

INTRODUCTION

Imagine the following situation: a Biology teacher gives students the task: "How does climate change affect local ecosystems?" Instead of each student writing an individual text, the students are divided into small teams. One team researches temperature changes, another monitors the impact on plants and a third analyses the impact on animals. Everything is recorded in a shared online document, where they comment on each other's ideas and develop the conclusions.

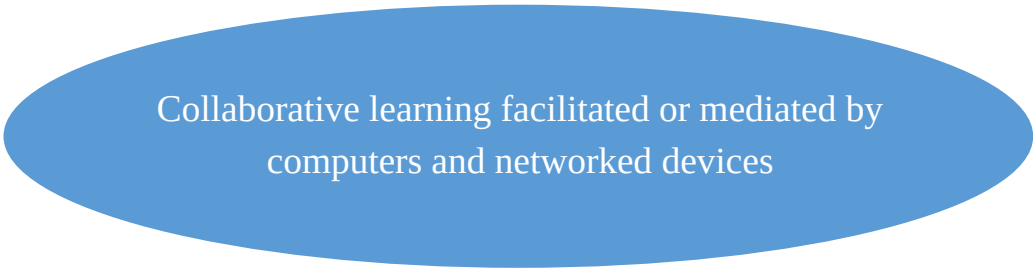
At one point, a student from one of the teams notices that the data they have found are not sufficient. The teacher puts them in touch with peers from another school, in another city, where students share their local observations. A discussion develops – the students ask questions, compare results and together reach a deeper understanding of the problem.

In the end, there is no "my work" and "your work", but rather a joint product – a presentation showing how, through collaboration, they arrived at knowledge that none of them could have built alone.

This story illustrates the essence of *computer-supported collaborative learning*: technology is not an end in itself, but a bridge that connects students, enables the exchange of ideas and turns learning into a shared process of discovery.

COMPUTER-SUPPORTED COLLABORATIVE LEARNING

Research has shown that peer learning is very important for developing problem-solving skills. Technological advances and the development of technology further support the development of collaborative learning. In this context, Computer-Supported Collaborative Learning (CSCL) is becoming increasingly important. In the broadest sense, CSCL refers to activities in which peers interact with each other for the purpose of learning, aided by information and communication technologies (ICT).



This approach places interaction at its centre and sees it as the basis of collaborative learning, both in exchanges between teachers and students and in peer group work. In addition, special emphasis is placed on the importance of emotional support within the group and its role in promoting and maintaining engagement and collaboration. In these processes, online collaboration tools play a special role in strengthening these interactions and emotional support. CSCL gives students the opportunity to:

- take part in a shared task
- communicate
- share resources
- take part in collaborative learning processes
- take part in the joint construction of knowledge,
- monitor and regulate collaborative learning,
- find and build groups and communities.

Source: Gutai et al., 2021.

We therefore conclude that the CSCL model emphasises **interaction** as the basis of collaborative learning, both in **exchanges between teachers and students** and **in peer group**

work. **Emotional support within groups** plays a key role in maintaining engagement and collaboration, while **online collaboration tools** help strengthen these interactions and facilitate the provision of support.

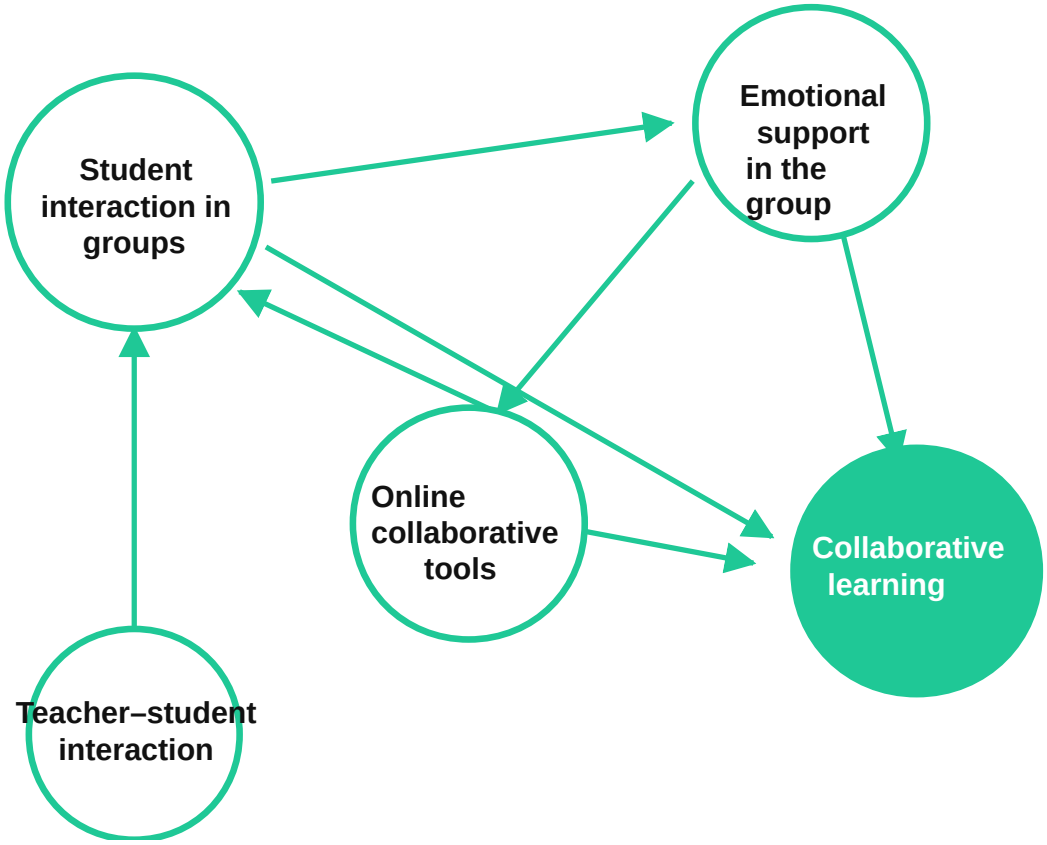


Figure 1. *Schematic diagram of CSCL* Source: Computer-Supported Collaborative Learning: Good Practices

CSCL can be applied/implemented:

- ✔ In online environments
- ✔ In the classroom

CSCL can take place:

- ✔ Synchronously (students communicate in real time, for example through video conferences or shared workspaces)
- ✔ Asynchronously (communication takes place with a time lag, for example through discussion forums, e-mail and/or collaborative documents)

Questions for reflection:

Can you give an example of a synchronous model?

Contemporary approaches to CSCL increasingly emphasise **hybrid** forms of learning, which combine face-to-face interaction with digital collaboration and integrate different modes of participation in physical and virtual spaces. Hybrid CSCL environments allow students to collaborate through multiple channels, enabling greater flexibility, continuity of learning and adaptation to students' different needs. When designing hybrid CSCL activities, teachers should carefully consider which parts of the task benefit from real-time interaction and which can be done independently.

Particularly important for CSCL are:

- **Type of task** – carefully designed tasks, with clear guidance, promote effective collaboration.
- **Group size** – smaller groups (3–5 students) usually contribute to greater engagement.
- **Role assignment** – assigning specific roles supports productive patterns of interaction.
- **Peer assessment** – exchanging work products between peers helps students prepare for subsequent meaningful interactions.
- **Collaborative scripts** – structured interaction flows increase cognitive engagement, support the negotiation of meaning and contribute to the joint construction of knowledge.
- **Debriefing (*debriefing*)** – helps students reflect, resolve misunderstandings and consolidate learning.

When we discussed the teacher's roles in collaborative problem solving, we stressed that the teacher is not a mere observer. Likewise, in the CSCL model, digital tools play an important role **and can support teachers, but they cannot replace the teacher's guidance of the teaching process.** The teacher's role is especially important for:

- Directing students' focus
- Giving support specific to each situation and context
- Responding to individual or group needs

PRACTICAL APPLICATION – RECOMMENDATIONS FOR TEACHERS

In the following section, we share with you possibilities for applying CSCL that other practitioners have shared with us and that they themselves use in their teaching practice. We also suggest some digital tools that can help you organise interactive and collaborative lessons.

✔ Collaborative content creation

Collaborative writing is a process of joint planning and writing that encourages students to express and develop a shared understanding. For example, in language/literature lessons, teachers and students can use CSCL in collaborative writing and reading tasks. In this way, groups of students can write and edit texts, stories and research papers together, using various tools. Applying CSCL makes it possible to follow the work of other group members in real time, record each member's contributions, leave comments and track changes.

Teachers can also encourage students to create video or comic content together. This can be useful for explaining how an algorithm works or for illustrating an imaginary conversation between a *hacker* and a cybersecurity expert, but this type of activity can also be useful in language, History and other subjects.

Tools

- ✔ Google Workspace for Education – allows co-creating (editing, commenting on) documents, presentations, spreadsheets and projects in real time, regardless of location.
- ✔ Google NotebookLM – allows students to upload their own study materials and uses AI to generate summaries, answer questions and create study guides based strictly on those sources.
- ✔ Animoto – allows the creation of professional-looking videos from photos, video clips, text, music, screen recordings and voice-overs, without the need for advanced video editing skills.
- ✔ Pixton – a comic creation platform designed specifically for education. Instead of making videos (as in Animoto), students create comic strips, graphic stories and visual explanations, using customisable characters, backgrounds, speech bubbles and scenes.

✔ Collaborative research and sharing

Collaborative research encourages students to explore various topics together and, in doing so, to seek a deeper understanding of the subject through group discussion and investigation. Students can tackle research tasks together, carry out group experiments and develop research projects.

Tools

- ✔ Padlet – a shared digital space where students can collectively post ideas, resources, questions and feedback in real time.
- ✔ Lino – a virtual sticky-note and collaborative canvas tool that allows notes, images, videos, links and documents to be posted on shared boards.
- ✔ PhET Interactive Simulations – for science experiments and simulations.

- ✔ Multisim, Miro, Coggle or MindMeister – as mind-mapping and simulation tools, they can help solve real-world problems through simulations and the visual organisation of concepts.
- ✔ PyramidApp – a tool that supports flexible collaborative learning through a pyramid (snowball) collaboration process: students first work individually, then discuss their ideas in pairs or small groups and, finally, build consensus in larger groups.

✔ Online collaborative laboratories

Virtual laboratories are particularly suitable for scientific investigations, such as biology experiments, chemistry procedures, environmental studies, physics simulations and engineering challenges, especially in schools without adequate equipment and materials. Virtual tours can be used to explore art, history, archaeology, cultural heritage, geography, architecture and social issues, allowing students to collaboratively analyse artefacts, historical events, scientific discoveries or cultural practices from different perspectives.

Tools

- ✔ Labster – a platform with a variety of simulations, models and experiments, which allows groups of students to carry out virtual laboratory experiments together; however, the advanced options are only available to licence holders.
- ✔ Google Arts and Culture Expeditions – a free educational platform that gives access to millions of artworks, historical artefacts, virtual museum tours, cultural stories and interactive learning experiences from more than 2,000 cultural institutions around the world. It includes virtual field trips, lesson plans, exploration of high-resolution artworks, augmented reality experiences and subject-specific resources, ranging from art and history to science, geography and computing.

✔ Learning and project management

Applying CSCL is important in the processes of managing learning itself. A characteristic application of CSCL is the coordination of group projects between students located in geographically distant places. CSCL allows students who are not in the same classroom to work on a research project, using asynchronous and synchronous tools.

- ✔ Trello – supports project-based and collaborative learning, helping students organise tasks, assign responsibilities, monitor progress and manage group projects through boards, lists and cards.
- ✔ Moodle – an open-source, structured learning environment that supports online and blended (*blended*) learning through course management, content delivery, quizzes, discussions, (peer) assignments and grading,

feedback and collaborative activities. Institutions can install and customise it freely.

- ✔ Google Classroom – facilitates class management: organising courses and communication, i.e. distributing assignments, feedback, communication and collaboration through integration with Google Docs, Slides, Drive and other Google Workspace tools.

✔ (Self-)assessment tools

CSCL environments also include structured peer assessment processes, in which students systematically assess and comment on each other's work. Although teachers usually use these tools to assess students' knowledge, they can be used to support peer assessment and collaboration – it is only important that teachers define clear criteria and roles and support students in formulating feedback constructively.

- ✔ Kahoot!, Gimkit, Quizizz, Quizalize, Quizlet – these are all tools for formative assessment and active learning. Immediate feedback can stimulate discussion and peer learning. Quizizz is the strongest for CSCL, because it supports live and asynchronous collaboration (students can work together or compare answers in real time or at their own pace), allows team modes, in which groups solve questions collaboratively, and encourages collective reflection through reports and review sessions.

- ✔ Mentimeter – an interactive presentation and polling tool that allows teachers to collect students' answers in real time via smartphones, tablets or computers. Students can vote on questions and take part in quizzes, word clouds, rankings and open questions, which increases engagement and participation during lectures or discussions.

✔ Collaborative programming

Applying CSCL is also particularly important for collaborative programming. Pair programming is also possible.

Tools

- App Inventor – encourages learning through play and exploration. Students can work together on the same project, using a shared design and blocks editor (often through screen sharing or working side by side), alternating the roles of driver (*driver*, who builds the blocks) and navigator (*navigator*, who guides the logic, debugs and checks the design).
- GitHub's widely used real-time collaborative code editor allows students to work on the same project, code collaboratively, divide tasks or work simultaneously, with all changes automatically visible to everyone.

- Scratch – a block-based programming environment designed mainly for learning to code by creating interactive stories, games and animations. It works very well for shared debugging, swapping roles and collaborative problem solving.

CONCLUSION

Remember:

- ✔ Technology alone does not imply collaboration – CSCL is only effective to the extent that tasks are well designed, roles are clear and interactions are meaningful.

- ✔ CSCL is not just the use of existing technologies in educational contexts.
- ✔ The different forms of CSCL (collaborative writing, research, project work, programming) open up opportunities for application in practically all subjects, regardless of the level of education.
- ✔ Regardless of the use of tools and computers, the teacher's role remains active and important in the teaching process.

QUESTIONS FOR REFLECTION

1. In what ways can you apply this model in practice?
2. What do you see as the advantages and what do you see as the disadvantages of CSCL?
3. Do you use any of the digital tools in your practice? Which tools would you use in your practice and for what purpose?
4. Which model works best with your students and in your context – synchronous or asynchronous? Why do you think that is?
5. How do you ensure that all students participate equally in CSCL activities?

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Ethical and responsible use of artificial intelligence in CSCL

ETHICAL AND RESPONSIBLE USE OF ARTIFICIAL INTELLIGENCE IN CSCL

As collaborative learning increasingly takes place in digital environments, teachers and students interact with a growing number of technologies, including artificial intelligence (AI). Within the Co-CREATE project, educators are encouraged to use digital tools, online collaborative platforms and the AI-supported Handbook to enrich learning experiences and support students in developing subject-specific and transversal competences.

However, the use of these technologies also brings new ethical considerations. Students may rely on AI-generated content without critical reflection, come across misinformation or biased outputs, or unintentionally violate principles of academic integrity. At the same time, teachers face challenges related to the responsible use of AI in instructional design, assessment, feedback and interpreting students' work.

Rather than avoiding AI, educators should develop the knowledge and confidence needed to integrate these tools responsibly and transparently. The ethical and responsible use of AI is therefore an essential component of Computer-Supported Collaborative Learning (CSCL), helping teachers create safe, inclusive and trustworthy learning environments, while preparing students for a society in which AI technologies are increasingly prevalent.

This chapter aims to support teachers in dealing with these opportunities and challenges, offering practical guidance for the ethical use of AI in educational contexts.

LEARNING OUTCOMES

The teacher will be able to:

- understand the basic concept of artificial intelligence (AI) and its role in education
- identify opportunities and risks associated with the use of AI tools in schools
- recognise ethical challenges related to privacy, bias, transparency and misinformation
- apply principles of responsible, human-centred use of AI in educational practice
- critically evaluate AI-generated content and support students in developing AI literacy
- encourage the safe, inclusive and reflective use of AI in learning environments

KEY CONCEPTS

- artificial intelligence (AI)
- generative AI
- AI literacy
- transparency
- human oversight
- data privacy
- bias and discrimination
- inclusion
- accountability
- digital citizenship

INTRODUCTION

Teacher Ivana noticed that several students had started using AI tools to help them with their homework. Some used AI to summarise texts or explain difficult concepts, while others copied entire answers without checking whether the information was correct. In collaborative learning activities, this also raised new questions: how can teachers know which ideas came from the students, which came from their classmates and which were supported by AI tools? One student handed in a text that seemed unusually advanced, but when Ivana asked him follow-up questions in class, he struggled to explain the ideas in his own words. At the same time, Ivana also discovered positive examples. A student with reading difficulties was using an AI-supported text-to-speech tool to better understand the material, while another student was using an AI *chatbot* to practise conversation in a foreign language after school. Ivana realised that artificial intelligence was neither entirely "good" nor "bad". Rather, its impact depended on how it was used, understood and guided in the classroom. The following week, she decided to talk openly about AI with her students. Together, they explored questions such as:

- Can AI make mistakes?
- Should we always trust AI-generated information?
- What happens to the data we share with AI systems?
- When does AI support learning and when does it replace thinking?

The class discussion was livelier than Ivana had expected. The students began to reflect not only on technology, but also on responsibility, fairness, creativity and trust.

Questions for reflection:

Have your students already started using AI tools in their learning?

In what ways can AI support learning and inclusion?

What risks can arise if AI tools are used uncritically?

How can schools help students become responsible AI users?

ARTIFICIAL INTELLIGENCE IN EDUCATION

Artificial intelligence (AI) refers to computer systems designed to perform tasks that normally require human cognitive abilities, such as recognising patterns, processing language, generating content, solving problems or making predictions. According to the EU AI Regulation (*AI Act*), AI systems are machine-based systems designed to operate with varying levels of autonomy that generate outputs, such as predictions, recommendations or decisions, that influence environments or people.

Today, AI systems are increasingly present in education through:

- *chatbots* and virtual assistants,
- machine translation tools,
- recommendation systems,
- adaptive learning platforms,
- text, image and presentation generators,
- automated feedback and assessment systems.

AI can support teaching and learning in many positive ways. It can improve accessibility, offer personalised learning support, help students organise information and assist teachers with preparation and administrative tasks. For some students, especially those with disabilities or learning difficulties, AI tools can reduce barriers and improve participation. However, AI systems are not neutral. They are trained on large amounts of data that may contain inaccuracies, stereotypes or social biases. AI-generated information can sometimes be incorrect, misleading, oversimplified or discriminatory. For this reason, AI should always be used critically and responsibly in educational contexts.

HUMAN-CENTRED USE OF AI

Technology should support people — not replace human relationships, judgement or responsibility. A human-centred approach to AI means that students' dignity, well-being, diversity and developmental needs remain the priority in educational practice. Teachers play an essential role in:

- interpreting information critically,

- supporting emotional and social development,
- understanding the classroom context,
- making ethical decisions,
- encouraging creativity and independent thinking.

AI tools should therefore support — and not replace — the teacher's professional role and students' active learning processes.

It is important to note that not all students have the same access to technology or the same digital skills. Schools should ensure that the use of AI does not deepen educational inequalities or disadvantage students with fewer technological resources.

TRANSPARENCY AND CRITICAL THINKING

One of the fundamental ethical principles in the use of AI is transparency. In CSCL activities, transparency is especially important, because students work together, share ideas, divide tasks and produce results jointly. When AI tools are used, students should clearly communicate how and why they used them, so that classmates and teachers can understand the collaborative process. Students and teachers should know:

- when AI tools are being used,
- what these tools can and cannot do,
- how the outputs are generated,
- and what limitations or risks exist.

AI-generated content should not automatically be considered accurate or reliable. AI systems may:

- generate false information,
- invent references or facts,
- reflect stereotypes,
- or present biased views as objective truths.

For this reason, students should be encouraged to:

- check information using reliable sources,
- compare several perspectives,
- ask critical questions,
- and reflect on the quality and credibility of AI-generated outputs.

In group tasks, students may also be asked to record whether AI was used to generate ideas, draft, translate, code, debug, summarise or organise

information. Developing these skills is part of AI literacy and digital citizenship.

PRIVACY, DATA PROTECTION AND SAFETY

Many AI systems collect and process users' data. In educational contexts, special care is needed when students use AI tools, especially when minors are involved. Teachers should avoid entering into public AI systems:

- sensitive personal information,
- students' grades,
- psychological or medical information,
- photographs or recordings of students,
- or confidential school documents,

unless appropriate safeguards and permissions are in place. Under the EU AI Regulation, AI systems used in education may be considered high-risk when they significantly influence students' educational opportunities or assessment outcomes. This means that schools and educational institutions should pay particular attention to safety, transparency, human oversight and data protection.

Students should also be encouraged to think carefully about the information they share online and about how digital systems may use that data.

FAIRNESS, INCLUSION AND BIAS

AI systems can unintentionally reinforce discrimination or social inequalities, because they learn from existing data produced by human beings. If these data contain stereotypes or unequal representation, AI systems may reproduce these patterns. For example:

- certain cultural perspectives may be over-represented,
- minority groups may be misrepresented,
- language tools may work better for some languages than for others,
- or generated examples may reflect gender stereotypes.

Teachers should therefore:

- critically review AI-generated materials before using them,
- discuss bias and fairness openly with students,
- include diverse perspectives and examples,
- and encourage respectful and inclusive discussions in the classroom.

AI should contribute to inclusion and equal participation, not to exclusion or discrimination.

AI LITERACY: TEACHING STUDENTS TO USE AI RESPONSIBLY

AI literacy means understanding:

- what AI is,
- how it works,
- what its limitations are,
- and how to use it responsibly and ethically.

Students do not need to become technical experts, but they should learn to:

- critically evaluate AI-generated information,
- use AI as a support tool rather than a substitute for thinking,
- recognise misinformation and manipulation,
- understand the ethical and social consequences of AI,
- and use technology responsibly and respectfully.

AI literacy is becoming an increasingly important part of education and democratic participation in contemporary society.

PRACTICAL APPLICATION — RECOMMENDATIONS FOR TEACHERS

How to encourage the ethical use of AI in the classroom

Use AI transparently

- In collaborative tasks, ask students to indicate whether and how they used AI, for example to generate ideas, check code, summarise information or improve presentation materials.
- If AI tools are used in lesson preparation or in learning activities, explain to students:
    - why the tool is being used,
    - what its purpose is,
    - and what limitations it has.

Encourage information checking

Teach students to compare AI-generated content with:

- textbooks,
- scientific sources,

- reliable websites,
- and classroom discussions.

Protect privacy

Avoid entering students' personal or sensitive information into public AI systems.

Focus on learning, not automation

Encourage students to use AI to:

- generate ideas,
- clarify difficult concepts,
- practise skills,
- or organise information, rather than simply generating finished work.

In CSCL settings, AI should support group discussion, peer explanation and problem solving, and not replace students' contributions to the shared task.

Discuss ethics openly

Use classroom discussions to explore:

- fairness,
- bias,
- misinformation,
- authorship,
- creativity,
- and responsibility in the use of AI.

Maintain human oversight

Teachers should always critically review AI-generated materials before using them in educational contexts.

Responsible use of AI in CSCL activities

In Computer-Supported Collaborative Learning activities, AI tools can support students in generating ideas, researching, organising information, coding, debugging, translating or preparing presentations. However, teachers should make expectations clear from the outset: students should explain whether they used AI, for what purpose and how the group evaluated or adapted the AI-generated output.

This is particularly important for assessment. When students work collaboratively, teachers already need to understand individual contributions, group processes and the quality of the final product. AI adds another layer to this process. Therefore, assessment should not focus only on the final product, but also on students'

reasoning, collaboration, decision-making and ability to critically evaluate AI-generated suggestions.

Used responsibly, AI can enrich CSCL activities by supporting inclusion, creativity and problem solving. Used uncritically, it can reduce learning, hide unequal participation or make assessment less fair.

QUESTIONS FOR REFLECTION

1. In what ways can AI support inclusion and accessibility in your teaching?
2. Which risks related to the use of AI in education concern you most?
3. How can students learn to use AI critically rather than passively?
4. What role should teachers maintain in classrooms increasingly influenced by AI technologies?

CONCLUSION

Artificial intelligence is becoming an increasingly visible part of education and everyday life. AI systems can support learning, accessibility, creativity and participation, but they also raise important ethical questions related to privacy, fairness, transparency and accountability. The aim of education is not simply to teach students how to use technology, but to help them think critically about it. Teachers therefore play an essential role in creating safe, reflective and human-centred approaches to the use of AI. This role is especially important in collaborative digital learning, in which teachers guide not only students' use of technology, but also the quality of interaction, shared responsibility and fairness in group work.

Responsible use of AI in education means ensuring that technology supports human development, democratic values, inclusion and well-being — keeping human judgement, ethical reflection and meaningful learning at the centre of educational practice.

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Appendix 1 – Choosing a laptop

APPENDIX 1 – CHOOSING A LAPTOP

Group task adapted to different learning styles

INTRODUCTION

This document contains seven versions of the group task from the lesson on Computer components. Each example is adapted to one of the seven learning styles described in the CO-CREATE Handbook for Teachers (Howard Gardner's theory of multiple intelligences), using the computer-supported collaborative learning approach. Each version is complete and ready to use. Teachers can choose the version that best matches their students' dominant learning style, or use several versions for differentiated instruction.

The task is the same for the different learning styles – to find a laptop whose specifications suit different uses. The assessment criteria are the same for all learning styles. What changes are the instructions on how to carry out the task. Although the students' roles in the team are the same, the instructions are adjusted according to the task.

LEARNING STYLE 1: LINGUISTIC

Choosing a laptop – group task (linguistic style)

Students who prefer the linguistic learning style learn best through language, reading, writing and verbal explanation. This version of the task values clear written communication, structured reasoning and the ability to articulate and justify decisions in words.

Your scenario and budget

You will now work in the same groups of 3–4 students.

Each group will receive a specific scenario and budget:

Scenario	Budget
Laptop for school use	**up to €700**
Gaming laptop (*gaming*)	**up to €3000**
Laptop for basic office work	**up to €1000**
Laptop for video editing	**up to €2500**
Laptop for programming	**up to €2000**

Roles in the team

Each group member takes on one of the following roles:

- **Researcher**: reads relevant sources and the group's mind map to find correct technical information. Takes notes in full sentences, explaining what each specification means and why it matters.
- **Recorder**: writes a structured summary of the group's decisions. Documents each specification choice with a written justification — not just the answer, but the reasoning behind it.
- **Technician**: finds the chosen laptop in an online shop, reads the product description carefully and writes a brief comparison between the product page description and the specifications agreed by the group.
- **Presenter**: writes a short script or notes for the final presentation. The script should tell the story of the group's decision — what the user needs, which specifications were chosen and why this laptop is the right choice.

If the group has three members, the Recorder and Presenter roles can be combined.

Although each group member has an individual role, collaboration is fundamental — everyone supports each other at every stage of the task. Each person is responsible for carrying out their role effectively and on time but, at the same time, contributes to the group's overall result.

What your group will produce

At the end of the task, your group will hand in the following written materials AND give a short oral presentation:

- A written list of specifications, with a brief explanation for each item (why this processor? why this amount of RAM?)
- A short paragraph describing the chosen laptop model and where you found it, including a direct comparison with the agreed specifications
- A 3–4 minute oral presentation, in which you take the class through your reasoning, step by step

Guidance for your presentation

Your presentation should tell a clear story. Use this structure as a guide:

- Present your scenario: who is this laptop for? What will they use it for?
- Explain your main specification choices: why did you choose this processor, this amount of RAM, this type of storage?
- Present the laptop you found: where did you find it? Does it match your specifications? Is it good value for money for the budget?

• Conclude with a recommendation: why is this the right laptop for this user?

Assessment rubric

Category	Description	Points
Technical specifications	The laptop meets the requirements of the scenario (processor, RAM, storage, GPU, screen, etc.). The specifications are realistic and fit within the given budget.	**0–2**
Finding a suitable model	The group found a specific laptop model in an online shop that meets the agreed specifications and offers the best value for money.	**0–2**
Group collaboration	All members participated actively, respected the collaboration rules, helped each other and carried out their roles responsibly.	**0–2**
Quality of the presentation	The slide is clear and informative and includes all the required details and visual elements. The presentation is clear, audible and lasts 3–4 minutes.	**0–2**
Explanation and justification	The group clearly explains why it chose these specifications and this laptop and how it meets the user's needs in the given scenario.	**0–2**

LEARNING STYLE 2: LOGICAL-MATHEMATICAL

Choosing a laptop – group task (logical-mathematical style)

Students who prefer the logical-mathematical learning style learn best through analysis, structured thinking, patterns and problem solving. This version of the task values systematic decision-making, comparative reasoning and data-based justification.

Your scenario and budget

You will now work in the same groups of 3–4 students.

Each group will receive a specific scenario and budget:

Scenario	Budget
Laptop for school use	**up to €700**
Gaming laptop (*gaming*)	**up to €3000**
Laptop for basic office work	**up to €1000**
Laptop for video editing	**up to €2500**
Laptop for programming	**up to €2000**

Your task: a step-by-step decision process

This task is structured as a logic problem. Do each step in the order given. Do not skip steps — each one builds on the previous one.

Step 1 — Define the requirements

Based on your scenario, list the minimum specifications the laptop must meet. Use the group's mind map and your prior knowledge. For each specification, record: (a) the minimum value and (b) the reason why that minimum is needed for this specific user.

Step 2 — Rank the specifications by priority

Not all specifications are equally important for your scenario. Together, rank the specifications from most critical to least critical and explain why you put them in that order.

Step 3 — Find the laptop

Search online shops for a laptop that meets your requirements. If you find more than one option, make a simple comparison: put the two laptops side by side with their main specifications and prices and then decide which offers the best value for money.

Step 4 — Confirm and check

Go back to the list of requirements from Step 1. Does the chosen laptop meet all the requirements? Tick each one off. If any specification is not met, explain why you chose this laptop anyway — or go back and find a better one.

Step 5 — Present your logic

Prepare a short presentation in which you take the class through your decision process, step by step. Show the list of requirements, the comparison (if applicable), the checklist and the conclusion.

Roles in the team

- **Researcher**: finds data on specifications and prices, using the group's mind map and online sources.
- **Recorder**: documents the group's reasoning at each step — keeps the list of requirements, the ranking and the comparison organised.
- **Technician**: finds the laptop in an online shop and carries out the check against the list of requirements.
- **Presenter**: prepares and gives the step-by-step presentation, showing the logic behind each decision.

If the group has three members, the Recorder and Presenter roles can be combined.

Although each group member has an individual role, collaboration is fundamental — everyone supports each other at every stage of the task. Each person is responsible for carrying out their role effectively and on time but, at the same time, contributes to the group's overall result.

Assessment rubric

Category	Description	Points
Technical specifications	The laptop meets the requirements of the scenario (processor, RAM, storage, GPU, screen, etc.). The specifications are realistic and fit within the given budget.	**0–2**
Finding a suitable model	The group found a specific laptop model in an online shop that meets the agreed specifications and offers the best value for money.	**0–2**
Group collaboration	All members participated actively, respected the collaboration rules, helped each other and carried out their roles responsibly.	**0–2**
Quality of the presentation	The slide is clear and informative and includes all the required details and visual elements. The presentation is clear, audible and lasts 3–4 minutes.	**0–2**
Explanation and justification	The group clearly explains why it chose these specifications and this laptop and how it meets the user's needs in the given scenario.	**0–2**

LEARNING STYLE 3: VISUAL-SPATIAL

Choosing a laptop – group task (visual-spatial style)

Students who prefer the visual-spatial learning style understand and retain information more easily when they can "see" it in an organised visual form. This version of the task values diagrams, visual layouts, colour-coded organisation and the visual design of the presentation.

Your scenario and budget

You will now work in the same groups of 3–4 students.

Each group will receive a specific scenario and budget:

Scenario	Budget
Laptop for school use	**up to €700**
Gaming laptop (*gaming*)	**up to €3000**
Laptop for basic office work	**up to €1000**
Laptop for video editing	**up to €2500**
Laptop for programming	**up to €2000**

Your task: think visually

This version of the task is based on visual thinking and organisation. You will use the group's mind map as a starting point and develop it visually.

Part 1 — Extend the mind map

Open the group's mind map from the previous activity. Add a new branch for your scenario. On this branch, attach the main specifications you need, with arrows showing the relationships between them. Use colours to indicate priority: highlight the most critical specifications in one colour and the secondary ones in another.

Part 2 — Create a visual representation of the specifications

Instead of a simple written list, create a visual overview of the chosen specifications. This could be:

- A diagram with boxes and arrows showing how each specification connects to the user's needs
- A colour-coded table, in which each row is a specification category and each column shows the minimum requirement, the chosen value and the reason
- A sketch or infographic-style layout of the laptop, labelling each component (CPU, RAM, storage, GPU, screen) with the chosen specification

Choose the format that best helps your group think clearly. You can create it digitally or by hand.

Part 3 — Find the laptop and compare visually

Look for the laptop in an online shop. Take a screenshot or note down the product image. In your visual overview, compare what is shown/described on the product page with your specification diagram. Are all the requirements visually confirmed?

Part 4 — Design the presentation slide

Your group will present with a single well-designed slide. The slide should:

- Clearly show the scenario and budget at the top
- Use a visual layout (not just a list) to present the specifications and the reasons behind them
- Include an image of the chosen laptop
- Make it immediately clear — at a glance — why this is the right laptop

During the presentation (3–4 minutes), take the class visually through the slide: point to specific elements, explain the relationships between components and show the mind map branch. The slide can be made in various presentation tools; use whichever suits you best.

Roles in the team

- **Researcher**: explores the technical information using the group's mind map and online sources; identifies the main visual relationships between the specifications.
- **Recorder**: creates and organises the visual representation of the specifications (diagram, table or infographic).
- **Technician**: finds the laptop in an online shop and annotates the visual representation with information from the product page.
- **Presenter**: designs the presentation slide and leads the visual explanation during the presentation.

If the group has three members, the Recorder and Presenter roles can be combined.

Although each group member has an individual role, collaboration is fundamental — everyone supports each other at every stage of the task. Each person is responsible for carrying out their role effectively and on time but, at the same time, contributes to the group's overall result.

Assessment rubric

Category	Description	Points
Technical specifications	The laptop meets the requirements of the scenario (processor, RAM, storage, GPU, screen, etc.). The specifications are realistic and fit within the given budget.	**0–2**
Finding a suitable model	The group found a specific laptop model in an online shop that meets the agreed specifications and offers the best value for money.	**0–2**
Group collaboration	All members participated actively, respected the collaboration rules, helped each other and carried out their roles responsibly.	**0–2**
Quality of the presentation	The slide is clear and informative and includes all the required details and visual elements. The presentation is clear, audible and lasts 3–4 minutes.	**0–2**
Explanation and justification	The group clearly explains why it chose these specifications and this laptop and how it meets the user's needs in the given scenario.	**0–2**

LEARNING STYLE 4: BODILY-KINESTHETIC

Choosing a laptop – group task (bodily-kinesthetic style)

Students who prefer the bodily-kinesthetic learning style learn best through hands-on work, direct experience and active physical involvement. This version of the task values doing, exploring, handling real tools and materials and learning through the very act of searching and comparing, rather than just reading about the subject.

Your scenario and budget

You will now work in the same groups of 3–4 students.

Each group will receive a specific scenario and budget:

Scenario	Budget
Laptop for school use	**up to €700**
Gaming laptop (*gaming*)	**up to €3000**
Laptop for basic office work	**up to €1000**
Laptop for video editing	**up to €2500**
Laptop for programming	**up to €2000**

Your task: a hands-on laptop hunt

In this version of the task, you learn by doing. You will go through a series of active steps, making real decisions and checking real products — not just discussing them in theory.

Part 1 — Field research: visit a shop

This task takes place before the lesson in which you will present. Your teacher will confirm the timing. Your group will visit an electronics shop together. Your mission is not to buy anything — it is to research through experience.

Step 1 — Prepare before you go

Before visiting the shop, sit down as a group and use the mind map to agree on what you are really looking for. Which specifications matter most for your scenario? Write down three to five key questions you want answered — questions you will ask a salesperson or whose answers you will find yourselves by reading the product information in the shop. Go in with a plan, not just curiosity.

Step 2 — Explore and try out

Once in the shop, find the laptop section and locate at least two models that could suit your scenario and budget. Don't just read the labels — pick them up, notice the weight and build quality, try the keyboard, check the brightness and

size of the screen. Open and close them. If a salesperson is available, ask the questions you prepared: *"What processor does this one have?" "Is this one good for video editing?"* Take photos, notes or short videos, where allowed. The aim is to experience the product, not just look at it.

Step 3 — Compare and decide

Before leaving the shop, have a brief group discussion right there. Which of the two models best suits your scenario? Which seems better for the user you have in mind? Weigh up the specifications, the price and your hands-on impressions together. Make a group decision and note down the reasons — you will need them for the *pitch*. If it is not possible to visit a physical shop, your teacher will arrange an alternative: a virtual visit in which you browse the shop's website together in real time, with one person sharing their screen, clicking through the product pages and reading out the specifications, while the rest of the group reacts and discusses — as if you were there.

Part 2 — The sales *pitch*: sell it in character (practical)

Back in the classroom, one group member plays the customer from your scenario. The rest of the group is the sales team.

Step 4 — Live *pitch*

The sales team presents the chosen laptop directly to the customer, drawing on everything they observed and decided in the shop. The customer stays in character and asks realistic questions as they go:

A student might ask: *"Can this handle Teams and Google Docs? Is it light enough to carry around all day?"*

A *gamer* might ask: *"Can it run the latest games on high settings? What is the screen's refresh rate?"*

A video editor might ask: *"How does it handle 4K footage? Is the colour accuracy good enough?"*

The sales team answers all questions with real observations and real specifications from the shop visit. You can use a slide as a visual aid, but the *pitch* should feel like a conversation rather than a rehearsed presentation — move around, point at the screen, show the product page if you can. The *pitch* lasts 3–4 minutes and ends with the customer deciding whether they are convinced and briefly saying why.

Roles in the team

- **Researcher**: leads Activity 1 (organising the specification cards) and looks for background information using the group's mind map.
- **Recorder**: takes notes during the live research and organises the side-by-side comparison in Activity 3.

- **Technician**: leads Activity 2 (the live search in the online shop) and finds the winning laptop.
- **Presenter**: builds the slide and leads Activity 4, pointing to and explaining each element during the presentation.

If the group has three members, the Recorder and Presenter roles can be combined.

Although each group member has an individual role, collaboration is fundamental — everyone supports each other at every stage of the task. Each person is responsible for carrying out their role effectively and on time but, at the same time, contributes to the group's overall result.

Assessment rubric

Category	Description	Points
Technical specifications	The laptop meets the requirements of the scenario (processor, RAM, storage, GPU, screen, etc.). The specifications are realistic and fit within the given budget.	**0–2**
Finding a suitable model	The group found a specific laptop model in an online shop that meets the agreed specifications and offers the best value for money.	**0–2**
Group collaboration	All members participated actively, respected the collaboration rules, helped each other and carried out their roles responsibly.	**0–2**
Quality of the presentation	The slide is clear and informative and includes all the required details and visual elements. The presentation is clear, audible and lasts 3–4 minutes.	**0–2**
Explanation and justification	The group clearly explains why it chose these specifications and this laptop and how it meets the user's needs in the given scenario.	**0–2**

LEARNING STYLE 5: MUSICAL

Choosing a laptop – group task (musical style)

Students who prefer the musical learning style learn best through rhythm, sound, melody and auditory expression. This version of the task channels that strength into something creative and purposeful: your group will research and choose a laptop — and then prove that you really understand it by writing and performing a short radio advert for it.

Your scenario and budget

You will now work in the same groups of 3–4 students.

Each group will receive a specific scenario and budget:

Scenario	Budget
Laptop for school use	**up to €700**
Gaming laptop (*gaming*)	**up to €3000**
Laptop for basic office work	**up to €1000**
Laptop for video editing	**up to €2500**
Laptop for programming	**up to €2000**

Your task: research the laptop and then sell it on the radio

A good radio advert is not just catchy — it is accurate. Your advert must be based on real specifications of a real laptop you have found. The better you understand what you chose and why, the more convincing the advert will be. This task has two parts of equal weight: the research and the performance.

Part 1 — Research and choose the laptop

Step 1 — Identify the key specifications

Using the group's mind map and any online sources, decide which specifications matter most for your scenario. Choose the top 5 the laptop must have — processor, RAM, storage, GPU, screen, battery life or any other relevant to your user.

Step 2 — Find the laptop

Search an online shop for a real laptop that meets your specifications and fits the budget. Note down the exact model name, the price and the main specifications. This is the laptop the advert will be about — make sure you know it well.

Step 3 — Understand why it fits

For each of the top 5 specifications, write a sentence explaining why that specification matters for your specific user. These sentences are the core of the advert — the facts you will turn into something worth listening to.

Part 2 — Write and perform the radio advert

Your group will write and perform a radio advert for the chosen laptop. The advert should last 60–90 seconds and must be performed live in front of the class (no reading a script word for word — perform it).

What a good radio advert includes:

- **A hook** — an opening line, a sound effect, a snippet of a *jingle* or a question that immediately grabs attention
- **The user** — make it clear who this laptop is for and what that person's life is like (a *gamer*, a student, a video editor…)
- **The key specifications** — mention at least 3 specifications from your research, but make them sound exciting and real, not like a data sheet
- **The laptop's name and price** — say them clearly, so that the listener knows exactly what to look for
- **A memorable closing line or *jingle*** — something that sticks in the listener's head

Tips for sounding like a real advert

- Use different voices — one person can be the narrator, another the "satisfied customer", another the announcer.
- Add rhythm or a *jingle*, if the group wants to — even a simple repeated, sung phrase counts.
- Vary the pace: slow down on the key specifications so that the audience really takes them in.
- Rehearse at least once before performing — timing matters.

Note: your advert will be assessed not only on creativity, but also on accuracy. If you say the laptop has 16 GB of RAM, it had better really have 16 GB of RAM. The class (and your teacher) will check.

After the advert — short question-and-answer session (1 minute)

After the group performs the advert, the teacher or classmates may ask you one or two quick questions about your choice — for example: "Why did you choose that GPU?" or "Would a cheaper option have worked just as well?". The whole group should be ready to answer based on the research notes.

Roles in the team

- **Researcher**: leads Steps 1–3 of Part 1; finds the key specifications and writes the "why it fits" sentences, which feed directly into the advert script.
- **Recorder**: writes the advert script based on the whole group's input; keeps notes on the specifications and the laptop found in the online shop.
- **Technician**: finds the laptop in the online shop (Step 2) and fact-checks the script — makes sure every claim in the advert matches the real product page.
- **Presenter**: leads the performance of the advert; decides who says what, manages the timing and ensures a confident and engaging delivery.

If the group has three members, the Recorder and Presenter roles can be combined.

Although each group member has an individual role, collaboration is fundamental — everyone supports each other at every stage of the task. Each person is responsible for carrying out their role effectively and on time but, at the same time, contributes to the group's overall result.

Assessment rubric

Category	Description	Points
Technical specifications	The laptop meets the requirements of the scenario (processor, RAM, storage, GPU, screen, etc.). The specifications are realistic and fit within the given budget.	**0–2**
Finding a suitable model	The group found a specific laptop model in an online shop that meets the agreed specifications and offers the best value for money.	**0–2**
Group collaboration	All members participated actively, respected the collaboration rules, helped each other and carried out their roles responsibly.	**0–2**
Quality of the presentation	The slide is clear and informative and includes all the required details and visual elements. The presentation is clear, audible and lasts 3–4 minutes.	**0–2**
Explanation and justification	The group clearly explains why it chose these specifications and this laptop and how it meets the user's needs in the given scenario.	**0–2**

LEARNING STYLE 6: INTERPERSONAL

Choosing a laptop – group task (interpersonal style)

Students who prefer the interpersonal learning style learn best through collaboration, communication and exchanging ideas with others. They acquire knowledge most effectively when they interact with classmates: explaining, listening, debating and solving problems together. This version of the task values structured group dialogue, peer explanation and collaborative decision-making.

Your scenario and budget

You will now work in the same groups of 3–4 students.

Each group will receive a specific scenario and budget:

Scenario	Budget
Laptop for school use	**up to €700**
Gaming laptop (*gaming*)	**up to €3000**
Laptop for basic office work	**up to €1000**
Laptop for video editing	**up to €2500**
Laptop for programming	**up to €2000**

Your task: decide together — through conversation

This version of the task is based on structured group conversation. All important decisions must be discussed and agreed by the group. No one decides alone — you decide together.

Round 1 — First, think individually (3 minutes)

Before discussing as a group, each person has 3 minutes to think in silence and write down their answer to this question: "For our scenario, which do I think are the three most important laptop specifications, and why?" Don't share yet.

Round 2 — Share and discuss (7 minutes)

Each person shares their three choices in turn. Once everyone has shared, discuss: what do you agree on? What do you disagree on? Try to understand each other's reasoning before arguing for your own position. The aim is to reach a group consensus on the top 5 specifications for your scenario.

Round 3 — Research and expert pairs (8 minutes)

Split the group into two pairs. One pair researches the technical side (processor and RAM); the other researches storage, GPU and screen. Each pair uses the group's mind map and online

sources. After 8 minutes, come back together and explain to each other what you discovered — each pair teaches the other what they found.

Round 4 — Group decision and laptop search (7 minutes)

Together, agree on the final list of specifications. Then the Technician searches for a real laptop that matches your specifications. Everyone checks the product page together and gives their opinion: does it meet the requirements? Is it good value for money? Make a final group decision.

Round 5 — Prepare and give the presentation (5 minutes' preparation)

Create a slide together. During the 3–4 minute presentation, more than one group member must speak — divide up the presentation so that at least two people contribute orally. The group should present as a team and not as a solo performance.

Roles in the team

- **Researcher**: leads the technical research in Round 3 and ensures that the group's mind map is used as a source.
- **Recorder**: records the decisions agreed by the group after each round; keeps the consensus list of specifications up to date.
- **Technician**: leads the laptop search in Round 4 and presents the product to the group for discussion.
- **Presenter**: organises the slide and coordinates who speaks in each part of the presentation.

If the group has three members, the Recorder and Presenter roles can be combined.

Although each group member has an individual role, collaboration is fundamental — everyone supports each other at every stage of the task. Each person is responsible for carrying out their role effectively and on time but, at the same time, contributes to the group's overall result.

Assessment rubric

Category	Description	Points
Technical specifications	The laptop meets the requirements of the scenario (processor, RAM, storage, GPU, screen, etc.). The specifications are realistic and fit within the given budget.	**0–2**
Finding a suitable model	The group found a specific laptop model in an online shop that meets the agreed specifications and offers the best value for money.	**0–2**
Group collaboration	All members participated actively, respected the collaboration rules, helped each other and carried out their roles responsibly.	**0–2**
Quality of the presentation	The slide is clear and informative and includes all the required details and visual elements. The presentation is clear, audible and lasts 3–4 minutes.	**0–2**
Explanation and justification	The group clearly explains why it chose these specifications and this laptop and how it meets the user's needs in the given scenario.	**0–2**

LEARNING STYLE 7: INTRAPERSONAL

Choosing a laptop – group task (intrapersonal style)

Students who prefer the intrapersonal learning style learn best through reflection, introspection and a personal connection with the material. They absorb information most effectively when they can relate it to their own experiences and think through ideas independently before sharing them. This version of the task gives each student structured individual reflection time before group work and asks students to reflect not only on their answers, but also on their reasoning process.

Your scenario and budget

You will now work in the same groups of 3–4 students with whom you created the mind maps. Each group will receive a specific scenario and budget:

Scenario	Budget
Laptop for school use	**up to €700**
Gaming laptop (*gaming*)	**up to €3000**
Laptop for basic office work	**up to €1000**
Laptop for video editing	**up to €2500**
Laptop for programming	**up to €2000**

Your task: reflect first, then collaborate

This version of the task begins with individual reflection. Each of you will think about the problem alone before contributing to the group. Your individual thinking will shape the group's final answer.

Phase 1 — Individual reflection (10 minutes, in silence and independently)

Before discussing anything with the group, answer the following questions in writing — for yourselves, in your own words:

- What does this scenario mean to me personally? Have I ever seen or used a laptop in a similar situation? What was my experience like?
- If I were the person in this scenario, what would matter most to me in a laptop — and why?
- Looking at the mind map our group made, what do I already know that is relevant here? What do I feel confident about and what am I unsure about?
- What are my top 3 specification priorities for this scenario and what is my personal reasoning for each one?

Write in full sentences. This is personal reflection time — at this stage there are no wrong answers.

Phase 2 — Share and build (15 minutes, group discussion)

When everyone is ready, share your reflections with the group. Each person explains their priorities and the personal reasoning behind them. Then the group:

- Identifies where members agree and disagree
- Discusses the reasoning behind the differences — not just what each person chose, but why
- Builds a final, shared list of specifications that everyone can support

Phase 3 — Find the laptop and check (10 minutes)

The Technician searches for a laptop that matches the list of specifications agreed by the group. When a candidate is found, each group member checks it independently against their personal priorities from Phase 1. Does this laptop meet what you personally identified as the most important requirements? Share your individual verdicts and then decide as a group.

Phase 4 — Prepare the presentation and the personal reflection slide

Create a presentation slide with your specifications and the chosen laptop. The presentation (3–4 minutes) should include:

- The group's scenario, budget and chosen specifications
- The chosen laptop and the reason for the choice
- A brief moment in which at least one group member shares a personal reflection: "What I found most interesting or surprising in this task was…"

Roles in the team

- **Researcher**: uses the group's mind map and online sources to gather technical information; shares their findings with the group after the individual reflection time.
- **Recorder**: collects the individual written reflections from Phase 1 (optional — students may keep them private) and records the list of specifications agreed by the group after Phase 2.
- **Technician**: finds the laptop in Phase 3 and presents it to the group for individual review.
- **Presenter**: builds the presentation slide and ensures that the personal reflection moment is included in the final presentation.

If the group has three members, the Recorder and Presenter roles can be combined.

Although each group member has an individual role, collaboration is fundamental — everyone supports each other at every stage of the task. Each person is responsible for carrying out their role effectively and on time but, at the same time, contributes to the group's overall result.

Assessment rubric

Category	Description	Points
Technical specifications	The laptop meets the requirements of the scenario (processor, RAM, storage, GPU, screen, etc.). The specifications are realistic and fit within the given budget.	**0–2**
Finding a suitable model	The group found a specific laptop model in an online shop that meets the agreed specifications and offers the best value for money.	**0–2**
Group collaboration	All members participated actively, respected the collaboration rules, helped each other and carried out their roles responsibly.	**0–2**
Quality of the presentation	The slide is clear and informative and includes all the required details and visual elements. The presentation is clear, audible and lasts 3–4 minutes.	**0–2**
Explanation and justification	The group clearly explains why it chose these specifications and this laptop and how it meets the user's needs in the given scenario.	**0–2**

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