Motives have the main role in motivation of students. Motives are the psychological characteristics of a personality which we consider to be the internal cause of behaviour towards experiences. We suggest the definition of motives as factors which awake, keep going, and focus the behaviour. Motivation is a psychological process, in which motives are implemented into the behaviour and experiences of an individual (by outside factors). Motivation results in certain, aimed activity.

Motives consist of elementary innate and learned structures of consciousness which are called needs. Needs are the elementary structures of motivation, which we can imagine as a condition of a lack or abundance in an organism, causing tension in an organism which is directed and starts activity.

This scheme illustrates the relationship between needs, motives, motivation and behaviour:

![Diagram showing the relationship between motives, motivation, and behaviour]

The classification of needs according to A.H. Maslow (1954) is important to mention: physiological needs, needs of security, needs of solidarity and love, needs of appreciation, and needs of self-fulfilment (inclusive of cognitive needs).

Education (teaching and learning) are complicated activities, implemented in schools typically in a social context, when a student reacts to the achievement requests of the teacher and school. In education, we can put forward three special groups of dominant needs in students which are being continuously developed: social needs, achievement needs and cognitive needs. The group of social and achievement needs usually includes the needs of identification and positive relationships (especially the teacher-student and the student-student relationship), status, influence, competence, realised goal of successful performance, and the avoidance of failure. Social and achievement needs lead to external motivation of the student which has a high motivational impact and which quite often contains a dominant motive. This boosted motivation can be both positive and negative and this is its biggest disadvantage. Luckily this disadvantage isn’t included in the group of cognitive needs on which we will concentrate.
**COGNITIVE NEEDS**

**PRIMARY NEEDS**
- Sensory activities
- Exploration (of surroundings)

**SECONDARY NEEDS**

**A. Purposeful cognition** (understanding)
- A.1: collecting of information
- A.2: systematisation and fixation of knowledge

**B. Development of cognitive abilities**
- B.1: development of single cognitive skills
- B.2: development of system of cognitive skills and habits results in development of cognitive abilities

**C. Solution of problems**
- C.1: identifying problems
- C.2: putting forward solution of problems
- C.3: independence and competency in solution of problems
- C.4: general respect and affection towards education

**D. With the relation to social and achievement needs**
- D.1: power of own education and cognitive abilities
- D.2: position and prestige by own education and cognitive abilities
- D.3: positive relations (indispensability and so on) by reason of own education and cognitive abilities
- D.4: to get success and to avoid failure by means of own knowledge, skills and abilities

Our system of cognitive needs in science education afore mentioned we compared with student’s activities in science education. What is identified is a set of cognitive motivation techniques by which students can be motivated including internal science cognitive motivation techniques and interdisciplinary cognitive motivation techniques.

**Science cognitive motivation techniques:**
1. Stimulation through unconscious perception and experimentation.
2. Use of models of natural objects and phenomena.
3. Application of systematisation of science knowledge.
4. Use of similarity and analogy between natural objects or phenomena.
5. Undertaking problem exercises and projects.
6. Demonstrating simple experiments and toys.
7. Seeing paradoxes and tricks.
8. Watching films, video programs, TV programs, and computer programs.
10. Visiting science museums and centres.

**Interdisciplinary cognitive motivation techniques:**
1. Science for life (especially related to social issues - health, food, energy, and environment).
2. Applications of science knowledge in technology.
3. Use of ITC in science.
4. History related to science discoveries and scientists’ lives.
5. Analysis of scientists’ quotations.
6. Use of sci-fi literature and films.
7. Application of relation between science and art.
8. Use of philosophical aspects of science.

An example of cognitive motivation technique:

*In many fairytale books we can see illustrations of the evening sky showing a shining moon. In four different illustrations the moon was (displayed as the following):*

![Illustrations of the moon in the evening sky](image)

(W) Which picture correctly shows the moon in the evening sky after dusk in a temperate zone in the Northern Hemisphere?
The correct answer to task 1 is (C): If you are looking at the southern part of the sky and see the moon, the moon will illuminated from the right by the setting sun in the west.

It is necessary to use the following student’s motivation ideas in science education:

(1) Individual motivation: Motivate each student according to their personal motivational spectrum.

(2) Variability: Use a variety of incentives to motivate all students.

(3) Adequacy: Pick appropriate incentives for each cognitive motivations teaching technique.

(4) Optimal proportion of motivation: Missing motivation as well as an over saturation of motivation can lead to a decrease of efficiency and interest of students. Optimal motivated behaviour illustrates a certain performance in satisfying the need. Necessary for reaching the optimal level of motivation energy.

(5) Formation of a spectrum of students’ needs and the creation of an interest in science: From the motivational point of view, forming a spectrum of students’ needs and the creation of an interest in science is a very important but also very difficult task for a teacher. It is possible to successfully develop the interest of talented students. In the case of untalented students, we try to at least create a positive attitude.

(6) The passage from external to internal motivation: The fundamental of this principle is the development of cognitive needs which are related to social and achievement needs. These cognitive needs form a bridge between internal and external motivation. We can involve a student with mathematical skills, and an interest in computers, in the solving of a numerical science problem, or in the computer modelling of an object or phenomenon. We can make the student, who is interested in history, more self-confident in science education by using his knowledge of inventions.

(7) The passage from the quantity of motivation to quality: If the student has already developed a positive attitude or even an interest in science, the quantity of his motivation changes into quality.

(8) Suppression of negative motivation: The principle here is part of the humanisation of teaching science and should be evident.

(9) Purposefulness, systematic, and connection to other elements of education: We must see teaching science as a complex system. Motivation of students, by itself, is not enough for success in teaching science. It is necessary to combine student motivation with other phases of teaching – approach, classroom atmosphere, student involvement and diagnostic measures.

(10) Interconnection with emotions and will: We should not forget the other parts of a student’s personality, which is closely connected to the student’s style of learning science.

References