CONNECTIVISM

This module aims to:

- Get the reader to think about education using ICT at a theoretical level
- Present connectivism as the theory that best reflects contemporary education
- Inspire with concrete examples of application

What digital skills does the module support for teachers?

- Continuing professional development

What areas of the digital competence of the students can I support with the knowledge I have gained in this module?

- acquire, access, critically evaluate, manage and share data, information and digital content, choosing processes, methods and means appropriate to the situation and purpose
- use digital technologies to facilitate their work, automate routine activities, streamline or simplify their workflow and improve the quality of their output
- understand the importance of digital technologies for human society, keep abreast of new technologies, critically evaluate their benefits and reflect on the risks of their use

Introduction

Whether we like it or not, the image of the world, the content of knowledge and, above all, the skills needed for life are changing more and more rapidly. The amount of information in our world is growing exponentially. The way information is acquired and evaluated is also changing. It seems that the ubiquity and interconnectedness of computers is changing the personal characteristics and ways of knowing of the new, so-called 'networked' generation. This means that, for the first time in human history, we are in a situation where we are preparing our students for life in an environment that we cannot imagine.

The whole situation is well illustrated by an excerpt from an interview with Ondřej Šteffl, the founder of Scio Schools:
"Electricity (1873) took 46 years to penetrate a quarter of US households, television (1926) took 26 years, the mobile phone (1983) did it in 13 years, the internet (1991) in 7 years. How fast did Google, digital cameras and tablets penetrate households? We don't know exactly, but it was faster again...
What is certain is that the world is changing faster and faster. We don't know what will happen 20 years from now. Labour market forecasters keep telling us that most of the jobs our children will be doing in 30 years' time do not exist today. Nobody knows exactly what they will be.

Studies by Oxford University researchers conclude that in the next two decades, 45% of today's jobs will be highly vulnerable to computerisation. We are talking about jobs. How will we and our children spend our leisure time in twenty years' time, what new sources of entertainment and education will emerge, what can medicine do for our health or our ageing? We don't know.

Even students who went to school in the 1960s grew up in a world that no one could have imagined, but the speed of change was not so obvious then, and we - the students of that time - actually lived with the idea that the world we were going to live in would be similar to the one of that time. Although it didn't turn out to be true, it didn't bother us at school.

The further back in history we go, the closer we get to a situation where change was so slow that nothing really changed in the world in a man's lifetime. He sowed in the spring and harvested in the autumn, married, built a house, had children. A son, like his father, with his grandfather's plough. People died with the feeling that they had experienced everything: birth, marriage, death, war, poverty and illness. There was no reason to believe that the next generation would be any different.

But for the pupils who go to school today that is no longer possible. In their short lives they have seen the birth and death of so many new things, technologies, projects, habits, relationships, that they inevitably perceive the world as changing and unstable. They perceive it differently to any generation before them.

No one can imagine the life that awaits today's children. The only thing that is certain is that changes, many changes, await them. And not all of them will be for the better. And school should prepare them for this life. But the children know, or at least suspect, that no one, not even the school, knows what kind of life it is preparing them for!

Surely the solution would be for the school to simply prepare the pupils for the changes, how to deal with them ritually, attitudinally and emotionally. To accept change as a challenge, to learn to be flexible and resilient, to be able to solve new and unexpected problems, to not be afraid to make decisions even in an uncertain situation. But this can hardly be guaranteed in today's schools. Just as you need a swimming pool to learn to swim, you need a changing environment to prepare for change. But a school, with its structure, with its predetermined areas of learning, is in principle a stable, prudent institution. It only asks questions it knows the answer to. How should students learn to solve new and unexpected problems?

The authority of the school was based, among other things, on the fact that the school knew what pupils should learn. And one of the most important arguments, though often unspoken, was that this was the kind of content that had worked in the past. But how can we persuade pupils today of the value of teaching when it is clear that neither they, nor teachers, nor curriculum designers, know what will be and therefore what will be needed?

As a result, children, adults and teachers are less and less confident that what is being presented to them at school is what they really need. Some of it certainly is, but much of it certainly is not".

Some educators have therefore concluded that a new theory of cognition needs to be formulated.

Educational theory

The idea of how cognition takes place and how this process can be influenced has changed considerably in the past. Whereas in the days of totalitarianism, revolution and the building of armies it was necessary to develop loyal citizens, workers who could understand instructions and soldiers who would blindly follow orders, today we know only one thing for sure - the main thing the next generation will need is creativity, the ability to learn throughout life, to make independent decisions and to adapt quickly to change. The following table shows four basic concepts that can be used to illustrate the development of educational theories over the last 100 years or so.

	Behaviorism	Cognitivism	Constructivism	Connectivism
Principle	black box - only external behaviour is examined	structured pro-grammable knowledge	individual cognition based on the social principle	understanding the information structures of the network
Why?	the carrot and stick method	guided cognition building on prior knowledge	personal commitment, social and cultural environment, activation	diversity of the network allows you to find the best way forward.
Memory functions	repeated experience	coding, storage, equipment	knowledge dynamically constructed on the basis of previous	knowledge is constructed on the basis of a dynamically changing network.
How?	stimulus, reaction	defining objectives according to the curriculum, implementation of the plan, verification	self-interest, personal contact with people	active participation in the network
Method	task performance (drill)	learning by heart, practising by heart, rehearsing	problem solving	comprehensive approach using different resources

Early 20th century behaviourism was not concerned with brain function at all. It saw the brain as a black box that translates incoming sensations (stimuli) into the resulting behaviour (reflection) of each individual. Like Newton's laws in physics, which are only valid under certain specific conditions, we can say that behaviourism works in some situations. For example, in the infamous experiment with Mr Pavlov's dog, or in the brainwashing of prisoners, etc. But it soon became clear that the process of learning by trying to induce reflexes was not enough. In the middle of the 20th century, progress was made in understanding how the brain works. It was discovered that there are neurons and that thought is produced by the excitation of the synapses that connect these neurons. Unfortunately, in the beginning, the idea of the distribution of neurons and the formation of synapses was static. On this basis, cognitivism defined the process of learning as the formation of connections in the brain that correspond exactly to what has been learned. This was achieved by storing appropriately encoded information in memory. The material to be learned was simply described by an outline, divided into the smallest possible sections, and these were gradually hammered into each student's head with constant repetition. The results were then tested. It is probably not necessary to describe this method of teaching too much, as we all know it well from our own experience.

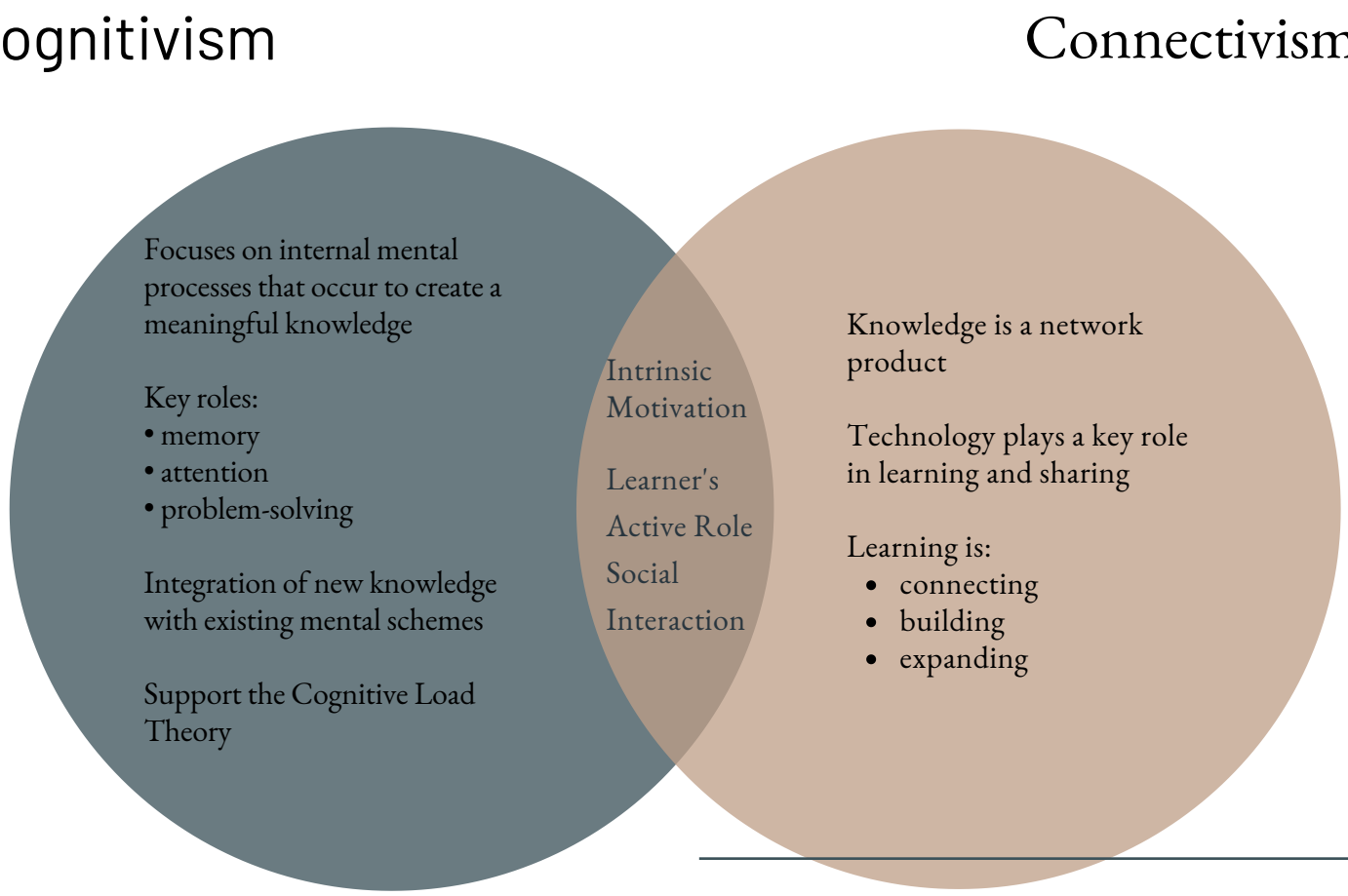
The static model of learning is quite applicable to static forms of knowledge where understanding the context is not very important. It can therefore be used very well for learning enumerated words, small multiplication tables, counting, etc. In all other cases (higher levels of Bloom's Taxonomy of Educational Objectives), it is necessary to accept the scientifically proven fact that the functioning of the human brain is a dynamic process based on the individual experiences and abilities of each person. Therefore, constructivism has taken the place of cognitivism among educational theories and brings a fundamentally different approach. It sees learning as a personal initiative in which new knowledge is constructed from existing knowledge through interaction with other people. It therefore seeks to create an environment in which there is as much personal activation as possible for the purpose of learning. Connectivism is actually an extension of constructivism and is fully compatible with it.

Connectivism

It has already been said that constructivism was the first educational theory to adopt a dynamic view of brain function. It is based on a model according to which the number of neurons in the brain, and even more so the number of synapses, changes dynamically during life. It is quite easy to imagine this process analogically as a network in which overall abilities are defined by knowledge linking uniformly stored information. These too undergo constant dynamic changes during life.

Connectivism is fully in line with this idea. However, like all previous theories, it tries to extend its scope of validity to the current conditions of the existence of technology-supported social networks (Web 2.0, Web 3.0). It overcomes the individual approach inherent in all existing theories and allows us to view learning as a property of the network beyond the individual.

The increasing amount of existing information and its easy accessibility leads to the need to understand understanding as a property of a network in which each member only possesses a certain part of the knowledge. The need to solve a given problem then leads to the temporary creation of dynamically variable connections for that particular task by the necessary network users, including the available information resources.
George Siemens, who published the article Connectivism, is considered the spiritual father of connectivism: A Learning Theory for the Digital Age (1), which is considered the foundation of the entire paradigm. Another prominent figure in the field is Stephen Downes, who authored the article An Introduction to Connective Knowledge (2) in which connectivism is elaborated in more detail.



1 Siemens, G. (2005). Connectivism: A Learning Theory for the Digital Age. International Journal of Instructional Technology and Distance Learning, 1-9. https://www.itdl.org/Journal/Jan_05/article01.htm

2 Downes, S. (2005). An Introduction to Connective Knowledge. https://www.researchgate.net/publication/248290359_An_Introduction_to_Connective_Knowledge

Basic principles of connectivism:

1. Learning is the process by which specialised nodes of a general complex network are connected (shared access to information resources, knowledge).
2. Cognition is based on a variety of different experiences (connection of different cultures, use of different technologies).
3. The ability to recognise is always more important than current knowledge.
4. Making and maintaining connections is a prerequisite for continuous cognition (community building).
5. The ability to recognise connections between different disciplines, concepts or ideas is a key competence.
6. Presence (timeliness) is an important attribute of connectionist educational activities (nothing has to be true tomorrow).
7. Even inanimate devices are capable of learning (network structure formation, information retrieval methods).
8. Self-determination is part of the learning process (changing reality requires the ability to change one's own attitudes).

Examples of possible implementation

Connectivism naturally develops in subjects where the level of involvement of ICT is the highest, i.e. primarily in computer science and information education, but also in other subjects it is possible to see considerable potential.

In the following section you will find examples of some simple applications of the connectionist approach and the traditional constructivist type of analogical problem.

1. C**onnectivism**: "Create an infographic on any topic on Wikipedia. Post it there and watch for any reactions to it."

Constructivism: "Create an infographic about poverty in the world."

2. **Connectivism**: "Find three scientists on ResearchGate who are working on a topic that interests you. Add them to your connections and try asking them a question, requesting a non-public article from them, or interacting with them in some other way".

Constructivism: "Find three scientists working on quantum dots."

3. **Connectivism**: "Throughout the month, use a personal wiki to write interesting information about a topic that interests you. Add links to each entry related to the topic you're following, add tags and share the whole result on your favourite social network".

Constructivism: "Find resources on global warming."

We could find an infinite number of almost similar analogue tasks. From the above trio it is clear that:

- Connectivist teaching is more time consuming. It is typically not confined to the school environment, but involves the constant involvement of the student as an active element of learning.
- Connectivist teaching works with different social networks. Interacting, sharing or getting information from them is directly part of the learning process itself.
- Connectivist teaching should respect the interests and specificities of the learner and can be highly individualised.
- Connectivist teaching should produce useful outputs not only for the learner's portfolio but also for others in the information environment.

A number of other sub-practices and conclusions can be drawn from the overall concept of connectivist teaching. Certainly, it is not necessary to include all of them in the classroom immediately, but we believe that some of them are quite crucial in terms of the information society in which we currently live. First and foremost is the emphasis on the formation of social bonds, which can be linked to feedback between students themselves. If they learn to collaborate and reflect on the work of others, this is clearly a positive benefit of such activities. Encouraging creativity, convergent thinking and unconventional approaches to problem solving is important for students' future employment.