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**TECHNICAL EDUCATION
IN KINDERGARTENS
IN THE CONTEXT
OF THE COGNITIVE LEARNING THEORY¹**

Abstract

The article deals with the theoretical aspect of the possibility of applying cognitive theory in technical education in kindergarten. The text includes a description of psychological elements of cognitive theory and their relation to technical education. The article describes technical education and its importance in preschool education. The authors pay special attention to the positive results of implementing the cognitive learning theory into technical education.

Keywords: cognitive learning theory • technical education • preschool education • kindergarten.

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EDUKACJA TECHNICZNA W PRZEDSZKOLACH W KONTEKŚCIE TEORII KOGNIWISTYCZNEJ

Streszczenie

W artykule przedstawiono teoretyczny aspekt możliwości zastosowania teorii kognitywistycznej w edukacji technicznej w przedszkolu. Tekst obejmuje opis psychologicznych elementów teorii kognitywistycznej oraz ich związki z edukacją techniczną. W artykule opisano kształcenie techniczne i jego znaczenie w praktyce nauczania przedszkolnego. Szczególną uwagę autorki zwracają na pozytywne skutki rozwoju osobowości dziecka wynikające ze stosowania teorii kognitywistycznej w edukacji technicznej.

Słowa kluczowe: teoria kognitywistyczna • edukacja techniczna • edukacja przedszkolna • przedszkole.

Introduction

It is not easy to live and find self-assertion in today's world of technology and information. We lead fast lives and society places many heavy requirements on us. Educational requirements are increasing. Huřová and Šukolová (2017) state that many countries attempt to harmonise the educational system with the labour market and needs of society. In addition, by harmonizing the educational system with social requirements, the quality of human resources will increase too. One of the societal requirements is the need for technical literacy, to which the educational system responds. Technical education is a part of life-long learning. Technology around us advances every day and plays an irreplaceable role in the life of the contemporary person. We are being prepared for living in the world of technique, technology and information from an early age. (Bajtoř – Pavelka, 1999). During a child's pre-school years, the foundations are laid for their future successful life. This is wha the kindergarten plays an important role in our lives. The kindergarten helps children to understand the world, teaches them how to live in it and adapts them to the technical advance of society. The implementation of elements of cognitivist educational theory (which goes hand-in-hand with technical

education) into kindergartens can considerably facilitate this preparation.

Implementation Cognitivist theory in kindergartens'

The implementation of elements of the cognitivist theory learning and upbringing into kindergartens is a much discussed topic currently. It is necessary to support people's development from childhood for their effective integration into society. Developmental psychology findings teach us that the most dramatic changes in children's lives occur during the pre-school age while holistic and harmonic personality development of children is crucial. This development is also supported by the cognitivist theory of education using elements which require more complex cognitive processes such as analysis and synthesis and developing children's logical thinking (Bertrand, 1998). The theory does not focus only on the development of cognitive processes itself. It respects the children's social environment and the current level of their development as well (Porubský, 2007).

The cognitivist theory of education and upbringing combines elements of two constructivist learning theories:

- cognitive constructivism;
- social constructivism (Molnárová, 2019).

Cognitive constructivism is based on the work of J. Piaget who developed the cognitive theory of children's development. Piaget assumed that the actual level of a child's development is based on its previous level. The next level is achieved through children's activity which contributes to the creation of subjective images about the rules of the world surrounding them. Further children's activity leads to acquiring experiences and their preconcepts are validated, reconstructed and incorporated into their knowledge base through assimilation and accommodation (Čáp – Mareš, 2007). Porubský (2007) states that the sequence of stages characterized in Piaget's theory is determined by maturation. These stages overlap each other during their transition period. The first three stages of Piaget's theory are given in the following table. The next stage

is omitted because pre-school pedagogy is oriented towards children up to 6 years.

Table 1. Stages of cognitive development of children up to 6 years according to J. Piaget

STAGE	AGE	BRIEF CHARACTERISTICS
Sensorimotor	from birth to 12. month	<ul style="list-style-type: none"> – motor activity, perception and experimentation; – beginnings of differentiation between themselves and other objects; – beginning of intentional conduct;
	12. month	<ul style="list-style-type: none"> – recognition of surrounding objects' stability
Preoperational	18. month	<ul style="list-style-type: none"> – children are still egocentric;
		<ul style="list-style-type: none"> – children learn to use language for labelling objects;
		<ul style="list-style-type: none"> – simple thought processes;
		<ul style="list-style-type: none"> – classifying objects based on single feature;
Concrete	7th year	<ul style="list-style-type: none"> – focus only on one object;
	6th year	<ul style="list-style-type: none"> – understanding of objects' unchangeable volume (e. g. play dough)
	6th year	<ul style="list-style-type: none"> – logical thinking, operating with abstract terms under condition that those can be perceived by senses

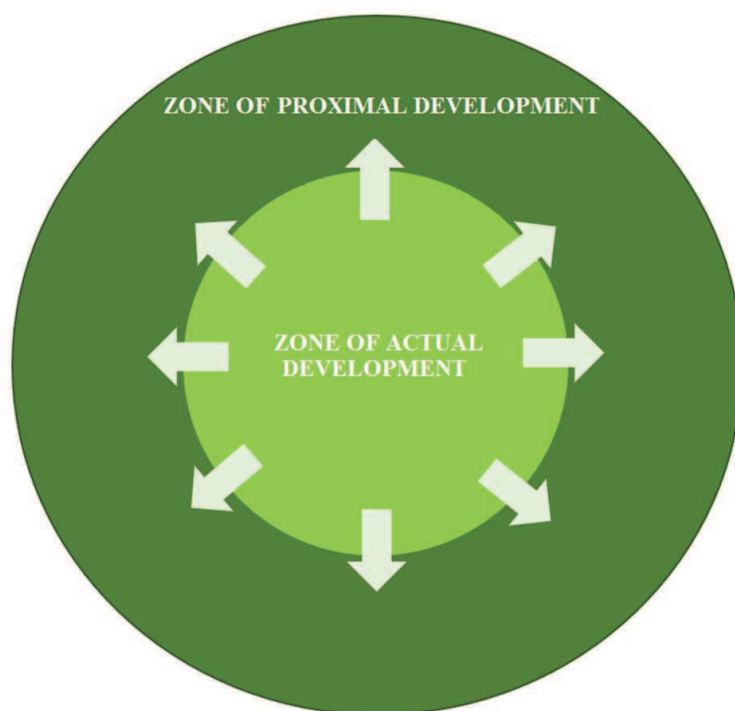
Processed according to: Atkinson, 2003, pp. 77 – 80; Čáp – Mareš, 2007, pp. 393, according to Molnárová, 2019, p. 30.

This branch of educational cognitivism concentrates on children's learning and mechanisms they employ while learning in all stages of cognitive development (Turek, 2010). Learning children construct their knowledge through interaction with the surrounding world. The children's approach to the world is determined by their current cognitive development level and their precepts. Children's precepts are validated or reconstructed by additional active learning. Learning comprehension is important (Vyskočilová – Dvořák, In: Kalhust – Obst et al., 2002). Construc-

tion of new knowledge on the basis of old makes the learning meaningful.

An important representative of social constructivism is L. S. Vygotsky. This author is known mainly thanks to his theory of child development. He distinguished the zone of actual development and the zone of proximal development. The zone of actual development includes activities that children can manage without the assistance of an adult. Children are more sensitive and capable of swifter responses to stimuli during particular periods of life. According to Vygotsky, these periods are zones of proximal development. They include activities that children can manage only with the assistance of an adult (Čáp – Mareš, 2007). The role of the kindergarten teacher is to recognize zones of proximal development and support and ensure the meaningful learning for children through instructions, effective and adequate communication and facilitation (Veselský, 2005).

Picture 1. Theory of development according to L. S. Vygotskyj



Resource: processed by the author.

In his theory, L. S. Vygotskyj puts emphasis on children's social and cultural backgrounds. He thinks background has an important effect on their cognitive development. Speech used by adults in the children's surroundings is also a part of the children's social environment. Through communication between themselves or between adults and children, adults attach certain meaning to objects and other phenomena. Children adapt this meaning from their parents, grandparents and teachers and the speech becomes their mental function – internal speech (Čáp – Mareš, 2007). Speech is also a form of interaction between children and the world. Veselský (2005) sees speech as a form of cooperation between the child and the adult or between children. Kindergarten represents the ideal framework for children's socialisation. Children can communicate with their peers or with their teacher. Therefore, kindergartens educators should often lead discussions and dialogues with children. The social environment and culture of society during childhood determine the direction and speed of the children's development and progress. It also determines the content offered to children (Turek, 2010).

Impacts of Cognitivist Learning Theory on Practice in Kindergarten

Opinions of aforementioned and other psychologists are reflected in education and training in kindergartens. We will mention some of them.

- A great emphasis is put on children's precepts. Precept is understood as a link between children's actual knowledge and knowledge offered in kindergarten.
- Based on the individual precepts of every child, the education and upbringing process is individualized.
- The children's cultural and social background is taken into account.
- A great emphasis is put on learning comprehension and meaningful learning.
- It is necessary to teach children in both an active and experimental way.

- The education and upbringing process in kindergarten should be authentic. It should be linked with ordinary life.
- Children's mistakes are considered as tools for learning.
- Children acquire further knowledge through their interaction with the world. Interaction can be understood as communication with, and manipulation of, objects in the world.
- Activities offered to children should make them active and trigger their abilities.
- Activities require employment of higher cognitive processes.
- The teacher acts as the children's facilitator and assistant in the education process.
- The teacher encourages the children in discussion and leads the dialogue with them.
- The teacher proposes activities based on cooperation and team-work.
- The teacher creates teaching situations that provoke cognitive conflict in children and lead them to conceptual change.
- Children can manipulate objects.
- Children can examine, explore and experiment.
- Children have an opportunity to construct their own knowledge based on the activity.
- Emphasis is put on all aspects of development of the child's personality: cognitive, socio-emotional and psychomotor.
- The children's cognitive abilities are developed: logical and divergent thinking, the ability to analyse, synthesise and evaluate.
- The memory, the creativity and the ability to create new products is developed.
- By overcoming obstacles, the children's self-confidence is developed and they experience joy.
- The methods applied are: concept mapping, problem-solving tasks, project-based learning, exploration activities, experiments, efforts etc. (Molnárová, 2019).

The theory of technical learning is very close to the cognitivist theory and in many ways, it is based on the ideas of psychological constructivism and its branches which it respects.

Technical learning in Kindergartens' Practice

Technique goes hand-in-hand with the man from the beginnings of humanity. It is a paradox that this term is not established even today. The council of Independent Colleges, on the basis of its research, defines technology as *“a social process which uses scientific and empiric potential of created tools, machines, devices, knowledge, procedures, sources and systems for influencing our life and our environment”* (Kožuchová – Pomšár – Kožuch, 1997, p. 6). Technology stays with us through our entire life in all its aspects. It helps us with problem-solving and facilitates our life. It allows us to grow on personal level and engage in broader society by creating new products. People need technical knowledge also for effective fulfilling of their social function and to live a full life. Technology does not influence only the individual's life. It influences the entire society therefore it should be also examined from social and moral viewpoints. It influences the country's economy and environment. For these reasons, technical education and development of technical literacy is a part of life-long learning and we should start developing technical skills from an early age (Kožuchová – Pomšár – Kožuch, 1997).

It cannot be denied that kindergarten is important in life-long learning, even in the case of technical education. In Kindergarten, children should not only learn about the technique itself and technologies, but about its social and ethical dimensions as well. Although, negative effects of technology on society and environment should not be overlooked. We can talk about technical education in the kindergarten, mainly in the context of acquiring basic technical literacy. Children start to understand basic principles and the essence of technology. They acquire and further develop their technical skills, they learn how to use natural materials creatively and how to work with tools and instruments. They also learn to resolve diverse technical issues, they are acquainted with professions related to technology and last but not least, they learn to evaluate technology in terms of ethics and social impact (Bajtoš – Pavelka, 1999).

The goals of technical learning in kindergarten are:

- developing basic skills;

- developing abilities to use everyday tools;
- developing elementary technical thinking;
- developing abilities to use theoretical knowledge in practical life;
- acquisition of knowledge about materials, their attributes and opportunities for their processing;
- acquiring basic technical literacy; (National Educational Programme for Pre-primary Education, 2016);
- motivating children to be active and developing their positive attitude towards work;
- supporting curiosity and exploration (Kožuchová, 2003);
- providing basic information about ICT use.
- Technical education in kindergarten supports:
 - development of graphomotor skills;
 - development of self-servicing activities, activities associated with everyday purposes and household;
 - development of elementary technical thinking;
 - development of perceptiveness and observation abilities;
 - the ability to create one's own procedures (National Educational Programme for Pre-primary Education, 2016);
 - the relationship towards oneself and one's own health;
 - the relationship towards nature, environment and ecology basics;
 - curiosity, self-sufficiency, responsibility, accuracy and diligence;
 - aesthetic sentiment, creativity and imagination;
 - a positive relationship towards one's own culture;
 - development of cognitive processes, higher cognitive operations, constructive and divergent thinking;
 - the ability to cooperate and work in team (Kozík, 2013).

Technical Education based on Constructivism Concepts

Technical education is based on concepts of constructivism and is very similar to cognitivist educational theory. In cognitivist theory, children are vital and active. They construct their own individual

knowledge built on their activities. New knowledge is integrated into already acquired knowledge creating schemes and complex cognitive structures. This knowledge is not determined solely by their cultural and social background, but also by their previous experiences, pre-concepts and current level of development.

Technical education follows the line of constructivism. Ďuriš et al. (2007) point out that technical education is also based on activity theory. Children create their own knowledge based on their activities and manipulation with objects. Technical education leads to the development of cognitive skills, it helps to develop children's thinking, creativity and encourages them to create their own products. Children find joy in technical activities. Children are naturally active and overcoming obstacles and mastering tasks supports their self-confidence and feeling of competence. Making a mistake is not an obstacle. On the basis of their own mistake, they can examine its cause and correct the mistake with the teacher's assistance. Children continue to learn through this process. Every child acquires different knowledge from their activities because every child is different and starts the process of technical creation with different pre-concepts and previous experiences. Therefore, the children's pace is taken into account and children can – to some extent – regulate their activity themselves. The teacher acts as facilitator and he should create authentic situations based on everyday life giving children opportunity to explore and manipulate and experiment with objects (Ďuriš et al. 2007).

The teacher mainly uses strategies of project-based learning, problem-oriented learning and cooperative learning for technical education (Huřová, 2017). A pre-primary education teacher should employ, above all, exploration activities giving children opportunity to observe, explore and manipulate using objects (Honzíková – Sojková, 2014). Kořuchová (1998) ranks brainstorming, mental mapping and didactic play among methods employed in technical education (Kořuchová, In: Kořuchová – Habšudová – Kuzma – Brnka, 1998).

Society recognizes the need for technical education from the children's pre-school years. Therefore, the National Educational Programme for Pre-primary Education in Kindergartens (2016) includes an educational area called The Man and the World of Work.

The main goal of the educational area is „*creating and developing children’s basic skills of managing everyday tasks and skills of using tools needed in everyday life with emphasis on developing those skills that are important for children’s development...*” (National Educational Programme for Pre-primary Education, 2016, p. 16) Children’s basic technical thinking is developed through this educational area. It sets the basis for future development of technical literacy linked with the introduction to the world of work, work activities and work ethics. Children acquire knowledge about materials, their attributes and opportunities of their processing. Children’s constructive thinking is developed and they learn to work following the instructions and different guidelines. They gain basic user skills but also skills needed for everyday life and for using ICT. They have the opportunity to manipulate with working tools and embrace some production methods and gain insight into the world of crafts and professions (National Educational Programme for Pre-primary Education, 2016).

In order to improve technical education in kindergartens, the Czech Republic created a project called Technical Kindergarten. The project’s goal is developing pre-schoolers’ technical thinking, creativity, manual and also communication skills. In Slovakia, the project was implemented in 2017 (www.statpedu.sk). Together with implementation of this project in mainstream kindergartens, special Technical Kindergartens were established. These kindergartens currently operate in Poprad, Prievidza, Lučenec, Trnava and Malacky. The project’s vision is the establishment of kindergartens with a technical orientation in all Slovak regions (www.ucn.sk).

Conclusion

General knowledge does not suffice for finding effective self-assertion in today’s society. Today’s society requires creative, hardworking people and lifelong learning. An IT society requires technical literacy from all of us. Nowadays, it’s difficult to find employment without technical knowledge and the skills and abilities to work with ICT.

The foundations of successful life are already being laid in the pre-school years. Therefore, kindergartens should provide children with knowledge and teach them skills that can be used as foundations for further learning and knowledge acquisition. Technical education based on the findings of psychological constructivism is, among others, one area of children's development in the kindergarten. If children can already acquire good basics of technical literacy in kindergarten then further education is easier, not only for technically oriented subjects. Implementation of technical education into kindergartens can facilitate children's acquisition of knowledge within mathematics and natural sciences. Their self-confidence and ability to cooperate, ability to think and their motor skills are developed. If the foundations for a relationship with technology and a positive attitude towards work are being laid at an early age, then society will consist of creative, trustworthy, skilful and hardworking individuals aware of both the positives and negatives of the technology used and employed by them in everyday life.

Relevant literature

1. ATKINSON, R., et al. 2003. *Psychologie*. Prague: Portál, 2003. 752 pp. ISBN 80-7178-640-3.
2. BAJTOŠ, J. – PAVELKA, J. 1999. *Základy didaktiky technickej výchovy*. Prešov: Prešovská univerzita v Prešove, 1999. 148 pp. ISBN 80-88722-46-2.
3. BERTRAND, Y. 1998. *Soudobé teorie vzdělávání*. Prague: Portál, 1998. 248 pp. ISBN 80-7178-216-5.
4. ČÁP, J. – MAREŠ, J. 2007. *Psychologie pro učitele*. Prague: Portál, 2007. 656 pp. ISBN 978-80-7367-273-7.
5. ĎURIŠ, M. et al. 2007. *Technické vzdelávanie v procese zmien*. Banská Bystrica: Univerzita Mateja Bela, 2007. 290 pp. ISBN 978-80-8083-530-9.
6. HONZÍKOVÁ, J. – SOJKOVÁ, M. 2014. *Tvůrčí technické dovednosti*. Plzeň: Západočeská univerzita v Plzni, 2014. 134 pp. ISBN 978-80-261-0412-4.
7. HUĽOVÁ, Z. – ŠUKOLOVÁ, D. 2017. Slovak primary education teachers' views about and attitudes towards contents of work and technical education. In *The new education review: the international scientific founded by three universities from Czech Republic, Poland*

- and Slovak Republic. Toruń: Wydawnictwo Adam Marszałek, 2017. ISSN 1732-6729. Vol. 47, no. 1 (2017), pp. 165-175.
8. HUŘOVÁ, Z. 2017. *Projektová, problémová, kooperatívna a výskumná koncepcia vzdelávania v pregraduálnej príprave budúcich učiteľov: pre oblasť technického vzdelávania na primárnom stupni školy*. 1st edition. Banská Bystrica: Univerzita Mateja Bela, Pedagogická fakulta, 2017. 79 pp. ISBN 978-80-557-1275-8
 9. KALHOUS, Z. – OBST, O. et al. 2002. *Školní didaktika*. Prague: Portál, 2002. 447 pp. ISBN 978-80-7367-571-4.
 10. KOZÍK, T. et al. *Analýza a zdôvodnenie revízie Vzdelávacej oblasti Človek a svet práce. Učiteľské noviny*. Publisher Štátny inštitút odborného vzdelávania Bratislava, 2013, vol. LX, no. 11, p. 25. EV 2461/08.
 11. KOŽUCHOVÁ, M. 2003. *Obsahová dimenzia technickej výchovy so zameraním na predškolskú a elementárnu edukáciu*. Bratislava: Univerzita Komenského v Bratislave, 2003. 224 pp. ISBN 80-2231747-0.
 12. KOŽUCHOVÁ, M. – HBŠUDOVÁ, M – KUZMA, J. – BRNKA, K. 1998. *Didaktika technickej výchovy*. Bratislava: Univerzita Komenského v Bratislave, 1998. 164 p. ISBN 80-223-1319-X.
 13. KOŽUCHOVÁ, M. – POMŠÁR, Z. – KOŽUCH, I. 1997. *Fenomén techniky vo výchove a vzdelávaní v základných školách*. Bratislava: Univerzita Komenského v Bratislave, 1997. 160 pp. ISBN 80-223-1135-9.
 14. MOLNÁROVÁ, D. 2019. *Edukačné koncepcie rozvoja poznania dieťaťa v materskej škole*. Banská Bystrica: PF UMB, 2019 [Master thesis] 94 pp.
 15. PORUBSKÝ, Š. 2007. *Učiteľ – diskurz – žiak. Osobnostno-sociálny model primárnej edukácie*. Banská Bystrica: PDF UMB, 2007. 145 pp. ISBN 978-80-8083-392-3.
 16. *Štátny vzdelávací program pre predprimárne vzdelávanie v materských školách*. Bratislava: ŠPÚ, 2016. [online]. Available at:
 17. <http://www.statpedu.sk/files/articles/nove_dokumenty/statnyvzdelavaciprogram/svp_materske_skoly_2016-17780_27322_1-10a0_6jul2016.pdf>
 18. TUREK, J. 2010. *Didaktika*. Bratislava: Iura Edition, spol. s. r. o., 2010. 598 pp. ISBN 978-80-8078-322-8.
 19. VESELSKÝ, M. 2005. *Pedagogická psychológia 2: Teória a prax*. Bratislava: Univerzita Komenského, 2005. 168 pp. ISBN 80-223-1911-2.
 20. <<http://www.statpedu.sk/sk/aktuality/spu-podpori-projekt-technicka-skolka-2.html>>
 21. <www.ucn.sk/aktuality/technicka-skolka>