Students understanding for AI in different educational levels

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Abstract: This article elaborates on the application of the AI (Artificial Intelligence) in education and how much AI is integrated or can be integrated in the educational system. To what extend students can adopt and understand AI depending on their age and stage of education. How they can use it in their daily activities, education or other aspects of their life.

1. INTRODUCTION

AI (Artificial Intelligence) plays a quite significant role in our life nowadays. AI has gone a long way in the last years. At the very beginning AI started with the idea of computer and cybernetic science. For a long time, people working in computer data processing were developing the AI but were not using the words "artificial intelligence". They worked to improve the process to help people in their day-to-day life. AI as a term is coined as part of a project and workshops at Dartmouth College in the mid-1950s. (B. Willizmson, R.Eynon, 2020) The time was not ready to understand what is it. AI surfaced after 2010. Then it gradually evolved as data-processing systems that can learn and make predictions by classifying and correlating huge quantities of "big data". (B. Willizmson, R.Eynon, 2020) In recent years AI is a very popular topic and now is part of all our life. Today we will discuss how AI can be used by children and adults.

AI crept through the industrial revolutions. Some people think AI is a driver to the fourth industrial revolution and it may trigger the fourth revolution in education. (X. Zhai et al. 2021) AI is a part of student education in University, in some technical disciplines such as programming, software engineering, IoT, computer science and etc. Is it possible AI to become a part of primary or secondary school education? Would AI be big revolution in education or just source of information without substantially changing the core educational practices. This motivated teachers to review current AI capabilities and identify possible pathways to optimize learning or integrate AI in their classes.

Loeckx suggested that AI could be an effective learning tool that lessens the burdens of both teachers and students and offers effective learning experiences for students (X. Zhai et al. 2021) Coupled with current education reforms such as the digitalization of educational resources, gamification, and personalized learning experiences, there are many opportunities for the development of AI applications in education. (X. Zhai et al. 2021)

Today AI is also challenged by teachers. Teachers started using AI in their routine habits such as writing emails, preparing presentations, finding good graphic materials, etc. and they use it in the classroom in the form of applications.

Emerging challenges also included students' attitudes towards these changes. (A. Flogie and B. Aberšek, 2015) To some extent, students as digital citizens are able to leverage AI to improve learning outcomes. (X. Zhai et al. 2021) Nonetheless, they may fail to use suitable AI techniques appropriately for a specific learning context, which would result in negative attitudes towards learning. (K, 2017)

In the period 2010 to 2020 the focus of AI was separated into three parts: knowledge representation, knowledge obtaining and knowledge derivation. (T. Horakova, M. Houska, and L. Domeova, 2017) This was the beginning of applying AI in education. It started with "first generation" which supported human intellectual work by applying rule-based expert knowledge, "second generation" search model which would find the optimal solution using a statistical model and the "third generation" recognized performance based on the brain model.

Educators already started exploring suitable applications of AI techniques in their teaching. There are currently some AI applications that have achieved the integration of technique, domain knowledge, and pedagogical design. (X. Zhai et al. 2021)

2. VARIATIES OF AI

The period 2010 – 2020 identified some research trends: the Internet of Things (IoT), swarm intelligence, deep learning, and neuroscience, as well as an assessment of the effect of AI in education.

In 1989 the International Journal of Artificial Intelligence in Education published a paper on AI in Education and the formation of the International AI in Education Society (IAIED). It's based on development of Intelligent Tutoring Systems Computer Assisted Instruction systems in the 1960s

and 70s.(B. Willizmson, R.Eynon, 2020) AI started its development in two segments: AI based tools for classrooms and usage of AI to understand, measure and improve learning.

Today there are a lot of tools for the classroom. That is because education is generally a complex system requiring visualization of subsystems and components, in which the invisible causal processes among subsystem/component behaviours would causally affect each other (S. Vattam et al, 2011).

It was suggested that systematic modelling should analyze three dimensions in the education context: learner's variation, learning domains, and learning activities (A. Casamayor et al., 2009, A. Gogoulou, 2008).

The aims of developing an AI-integrated system in education could be grouped into four types: classification (5 studies), matching (3 studies), recommendation (5 studies), and deep learning (10 studies). (1) Classification refers to the reconstruction of knowledge bases, in which the materials could be categorized according to varied characteristics. Classification demarcates knowledge content, which contributes to the accuracy of text analysis (T. Horakova et al, 2017). For example, some researchers developed an ITS with the characteristics of categorizing motion problems, by which learners could easily access different types of motion problems in Mathematics (V. V. Nabiyev et al, 2016). (2) Matching refers to a conversion mechanism, in which varied sets of classification are connected to specific learning purpose. For example, a text-to-diagram system was developed for blind students to link geometry words to an underlying diagram on the Braille printout, which has been certified as an effective teaching/learning tool at a Blind school (A. Mukherjee et al, 2014). (3) The recommendation is regarded as an intelligent authoring tool. With the support of the natural language process, it could automatically create new themes, theories, and pedagogical contents as a response to learners' feedback, to help teachers save time and effort (M. Liu et al, 2017). It constructed a human-computer interaction and widely used to generate real-time and intelligent feedback according to learners' input, which has been regarded as a reliable feature in modern assessment system (K. R. Malik and T. Ahmad, 2017). (4) Deep learning, or machine learning, is a comprehensive approach of big data processing and learning behaviour analysis. Based on the proliferation of big data in education, such as learning or teaching behaviour, the system could self-adjust to meet users' dynamic requirements by upgrading its algorithms (B. Williamson, 2018).

Another variable is Ohlsson's theory: students can learn from the feedback (A. Tüfekçi and U. Köse, 2013) Besides, a learning website, Jutge.org, was developed with the features of a rich and well-organized problem repository. The website provides instant feedback and helps students to progressively solve problems and learn from their mistakes. (J. Petit et al., 2018) Immediate feedback promotes active training in interactive learning environments, but only in high school or Universities. (I. Zipitriat et al., 2013)

What is the effect on students' learning? It is not only one. Firstly, it may help learners to optimize the elucidation of the relationships between the subcomponents of a particular topic. In return, the intelligent reasoning system can be used as a form of evaluation to assess if the student has captured enough

concepts for the given topic (G. P. Jain et al., 2014). Secondly, the system could provide an argumentative interaction which placed great significance in the construction of collaborative learning atmosphere. It is because, as a result of peers' reasoning, learners tend to externalize their arguments and improve their premises. Jain et al. (G. P. Jain et al., 2014) combined visualized mapping tool with collaboration scripts. The design successfully helped learners to analyze and evaluate opposing positions on contentious topics. Generally, researchers regarded the reasoning visualization tools as valuable scaffolds to develop learners' critical thinking and writing (C. Rapanta and D. Walton, 2016).

In time educators provide adaptive scaffolds for diversified learning environments with various types of learners. Different from the feedback system that offers stock responses, the adaptive educational system is a formative and corrective automated system that can adjust itself (target of intervention) to suit individual learners' characteristics, needs, and preferences (pedagogical objective) (A. Jones, 2011) (X. Zhai et al. 2021). Some researchers were very positive to the future promotion of adaptive systems in teaching and learning. (X. Zhai et al. 2021) Technologies such as intelligent speech recognition and automated writing evaluation (G. Kessler, 2018) have been tested with promising findings. In addition, there was substantial evidence showing that adaptive intelligence enhances learning by automatically enabling learners to locate and access proximal educational resources with respect to navigation and presentation support (D. H. Jonassen, 2011).

At that moment AI can be classified also as "Low AI", "High AI" and "Super High AI". "Low AI" for example are Digital Assistants like Alexa and Siri. "High AI" can solve any task just like a human such as Bard, chat GPT. "Super high AI" are still not available.

3. AI IN DEFFERENT EDUCATIONAL GRADES

There are four educational degrees in Bulgaria: Primary degree, secondary degree, high school and University. Every grade may benefit from the AI nowadays. During the last year 2023, AI was introduced as a concept and was also accepted as an additional tool in the education. People started using different educational elements from AI. They were finding more and more ways to study online, to use different tools useful for them or their children, and many teachers started searching for alternative ways to help their students. It was a key moment to integrate new opportunities as AI, to create more contents, to understand main AI principles.

A thematic analysis of 50 AI education studies from 2016 to 2022 was conducted, evaluating pedagogies, teaching tools, learning contents, and assessment methods among secondary students. Results were identified: (1) Collaborative project-based learning, involving interdisciplinary problem-solving through artifact creation, emerged as the most common pedagogical approach; (2) Teaching tools were categorized into hardware, software, intelligent agents, and unplugged tools; (3) Junior students focused on experiencing AI and basic concepts, while senior students explored advanced and technical components; (4) Assessments included knowledge tests, questionnaires, and qualitative analysis (e.g., videos,

documents, presentations); (5) Students' learning effects were measured across affective, behavioral, cognitive, and ethical dimensions.(Davy Tsz Kit Ng, 2023)

The adoption of AI can be classified quite clearly today.

Primary school. AI for Kids, from the "AI Singapore" project, is aimed solely at elementary school pupils who should learn about fundamental AI concepts and use AI-driven tools and applications ethically (AI Singapore, 2018b) (Jiahong Su, 2022)

Secondary school. In 2018, the Singapore government announced the "AI Singapore" project which aims to develop students' AI capabilities. two artificial intelligence research programs, "AI for Students" and "AI for Kids" had also started. The former movement aims for facilitating a curriculum for all secondary school students via formal and informal learning experiences (e.g., AI Makerspace, Data Camp, and Society Discussion Forum) (AI Singapore, 2018a). (Jiahong Su, 2022)

High school. I. Lee, B. Perret shared findings on teacher outcomes from the implementation of two one-week PD workshops during the summer of 2021 and shared suggestions for improvements provided by teachers. The participants in the PD program were secondary school teachers from the Southwest and Northeast regions of the United States who represented a variety of STEM disciplines: Biology, Chemistry, Physics, Engineering, and Mathematics. (I. Lee, 2022)

Participants' learning outcomes and reactions to the curriculum and PD workshops signify the promise of an integration approach for offering AI learning experience within high schools. The notable differences between the two cohorts of teachers and their respective outcomes lead us to believe that a strong foundation in mathematics and prior exposure to computer science concepts and professional programming languages may advantage some teachers over there. Furthermore, we found that the discernment between AI methods as a cognitive task proved to be well within reach of high school teachers. Irrespective of teachers' learning outcomes and core subjects they teach, all teachers expressed a great deal of comfort in leading the lessons. (I. Lee, 2022)

University. Students in University were the first users in AI. They learned based programming and then developed different apps or other varieties of AI.

AI is classified in each education level:

Preschool usage of AI: unplugged activities for familiar with robots or intelligent agent - Expression Song, Wake-up Song, Dress-up Song, Small Mirror, Ting-a-Ling, Magazines, Take a Walk in Park, Chairs, Desk, TV, Mom's Couch, My Tiny Closet, Knife, Small Bridge, I Love Guitar, Small Sheep, Fox, Monkey, Tricycle, Red Light Green Light, Greedy Bear Bobby, Monkey goes to School.

Primary school usage of AI: Basic Programming with Scratch and Python, Sensing the surrounding environment with Arduino, getting familiar with a variety of robots.

Secondary school usage of AI: Intro to AI, Perceptions of AI, Use many sensors, Solve problems through data and algorithms. AI laboratory (e.g., robot, face recognition and voice recognition). Python (basic programming and application).

High school usage of AI: Understand AI, Applications of AI, Foundations of AI, History of AI, Strong AI Weak AI, AI Ethics, Intro to NLP, AI Language, Parts of Speech, Natural Language Processing, Word Vectors, Syntax Parsing, Information Extraction, Knowledge Map, Problem Solving, Logic Inference, Expanding Logic Inference, Recognition Framework, Train Decision Tree, Search Engines.

University students mainly do programing in C#, C++, Java, C to explore AI capabilities and also to additionally develop it. Artificial Intelligent is very interesting word. Art is human activity and has a result same product. Intelligent is educated person. Artificial is the state of being the product of intentional human manufacture, that means AI is a product. We have a lot of apps today and more and more are being developed.

4. RESULTS AND EXPECTATION

We used AI in a small private school, involving 130 students from primary grade, secondary school, high school and students from university.

Students in **primary grade** do not really understand what AI is. They understand that they use same app, but they cannot understand the main theory of AI. They just play and have fun time with chat GPT. Interesting moment is that they are happy using chatGPT because they could talk with "somebody". They see a friend in the "face" of AI. This is useful when parents are busy and children cannot play with real friends and spend a long time at home alone.

Students in teen age. **Secondary grade**. They use AI with different apps in their daily life and at school. But they also do not fully understand what they use AI. Later teachers explain about chatGPT and how to use it doing their duties. At first, they used it to prepare their homework but were surprised that AI isn't so good in that. They saw that information wasn't correct. The chatGPT can find information but this information is mixed, incorrect and misleading in some cases. Students at this age know precisely which information is correct and which is incorrect. They can use other AI apps or can provide more configuration parameters, but this requires more time. They also see that their teachers use other apps to make their lessons more attractive and explanatory. Teachers explain where and how exactly they used chatGPT preparing their lessons. That explains which parameters for chatGPT makes it most effective.

High grade students use chatGPT in the most appropriate way. They understand quickly how it operates, what arguments are requires and how to get as much as possible from it. They understand in which aspects AI is helpful and in which not. We offered them to use AI to prepare their presentations for same class projects. They used it as a framework, but soon realized that it is quite inaccurate with regards to the content. Contents was incorrect in its bigger part in Bulgarian language. They had greater success when the content was in English. Teachers also gave examples on how to use it for picture generation. They had some fun but it took longer time to prepare good and meaningful picture. Students also had very nice and interesting ideas. The ones who didn't have art habits used chatGPT easily thenstudents who have more expectation and conditions in chatGPT to prepare their image.

Students from **University** used chatGPT for their project, but they also realized that AI gives them equal information and they can't be unique and they need to prepare their projects using more of their knowledge and creativity. Chat GPT produces similar or equal results when used with similar or equal parameters. Some students didn't present their projects because other their colleagues show the same projects. Students from University understand AI better and they search way to use more AI in their studies or daily life. Additionally, they also think about additional improvements of AI, to create new AI including developing chatGPT itself.

Students in all grades realize that chatGPT isn't perfect AI. It may help you, may give quick information but cannot fulfil end to end assignment, project and etc. In some case it can be good and fast but in other cases it can be incorrect and require more time configuring than saving time which could be a disadvantage.

It showed that the challenges for the preparation of personalized learning is the inappropriate sequencing of contents. The restructuring of presentation sequences is seeking a way to redefine the organization of knowledge according to the student's search. In this situation, feedback is an important approach to meet learners' learning patterns (F. R. Melo, et al., 2014.)

Using an artificial neural network in AI, the system provides immediate feedback according to students' input to help them gradually get access to the abstract concepts and perform practical exercises.

When students used chatGPT the challenges could be classified into three categories: technique, teachers and students, and social ethics.

5. CONCLUSION

In this research study we actively used standard chatGPT. The next step will be to explore the Bulgarian version of chatGPT which will be presented and integrated in march 2024. We could expect this version to be more adequate than regular chatGPT for our tasks.

The other conclusion is that Bulgarian educators need to work with AI engineers to address the gaps between technique and pedagogy. Some of the teachers are still not prepared to use and work with chatGPT or other AI.

Students understand that chatGPT can accomplish some tasks without human intervention. This AI is a 'machine learning', methods such as neural networks are used to train computers and now we question the applicability of this method to education.

This approach pays attention to the relations between various problematic units of analysis as flawed data, partially incomprehensible computational methods, narrow forms of educational' knowledge baked into the online environments, and a reductionist discourse of data science with evident economic ramifications.

Bulgarian education starts integrating stem education with main goal teacher to use more problem-based learning. That is what we did in our case study. And can defined that real world problems are badly structured, and it seems that computational paradigms have largely ignored their importance.

The current trend in our education is profiling students in certain areas. Such areas might be business, management, technicians, physicists, etc. Nowadays it is not enough that in the school or university you receive the basic ground knowledge that you can further develop on your own. It is quite necessary to achieve knowledge based on real tasks, assignments and solving real problems that may occur to you as a professional. In this aspect, the challenge for teachers, is how actually they can support and conduct such assignment and project based education. May be STEM and AI will support them in that endeavour.

An open learning environment allows the learner to learn what he or she wants when he or she wants it in the manner of his or her choice (Van den Brande, 1993; Tergan et al., 1992) (Irene Lee, Beatriz Perret., 1997)

Yet another challenge we face – how to assess and classify the information we can get from so many sources?

Currently students and even teachers must deal with the processing of a huge amount of information. As we know, the main advantage of the computers is to process and store information. So new and new information is created and stored every day. Students and teachers know that and somehow start using it. Yet just using any information you get is not enough. We should know how to use this potential, this ready information we have. We need didactics on how to create appropriate tasks and problems for solving so that this knowledge can be appropriately used in accomplishing assignments.

ChatGPT environment has been developed to use large amounts of data as a source and was used for its flexibility of finding and generating information for our own purposes and tasks.

The main goal of AI is transforming the teacher from a source of information into a mentor who navigates students to the knowledge in a certain area.

This article tried to show the relation between educational goals and the techniques that are used to support the achievement of these goals using chatGPT. Our research shows that these new technologies may use AI techniques as complementary support in education.

Children were able to explore and discuss activities in pairs or in small groups.

Teachers in this research who used chatGPT as AI methods already changed their attitude toward using AI. All of them share that they feel comfortable using AI in their classes. The provisioning of some modular parts of the AI can be incorporated in the current curriculum. In our case chatGPT was not that successful in Bulgarian language and Bulgarian literature but for the math, programing, robots, biology, geography, other languages etc. can be used with greater success.

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