Javlonbek ABDUJALILOV,
Muhammad al-Xorazmiy nomidagi Toshkent Axborot texnologiyalari universiteti mustaqil izlanuvchisi
E-mail: javlontuit@gmail.com
Tel.: 99 803 29 12

Andijon davlat pedagogika instituti dotsenti PhD Axmadaliyev D. taqrizi asosida

NEED ANALYSIS FOR LEARNING AND TEACHING ARTIFICIAL INTELLIGENCE AND ROBOTICS IN GENERAL SECONDARY EDUCATION OF UZBEKISTAN

Annotation

In this article, we conducted survey for measuring the perception of teaching and learning of artificial intelligence and robotics programming in secondary education in Uzbekistan. We chose to take a survey with four group of participants. They are high school students (10th and 11th grade school students), their parents, ICT teachers and school principals are invited to participate. 12 schools were included for the survey located in Tashkent city. Each respondents survey paper was coded, and survey results were analyzed based on respondents' opinion.

Key words: Artificial intelligence, robotics, software programming.

АНАЛИЗ НЕОБХОДИМОСТИ ОБУЧЕНИЯ И ПРЕПОДАВАНИЯ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА И РОБОТОТЕХНИКИ В ОБЩЕМ СРЕДНЕМ ОБРАЗОВАНИИ УЗБЕКИСТАНА

Аннотация

В этой статье мы провели опрос для измерения восприятия преподавания и изучения программирования искусственного интеллекта и робототехники в системе среднего образования в Узбекистане. Мы решили провести опрос с участием четырех групп участников. Это старшеклассники (учащиеся 10 и 11 классов), к участию пригласили их родители, преподаватели ИКТ и директора школ. В исследование были включены 12 школ, расположенных в городе Ташкенте. Каждый опросный лист респондентов был закодирован, а результаты опроса анализировались на основе мнения респондентов.

Ключевые слова: Искусственный интеллект, робототехника, программирование.

O'ZBEKISTON UMUMIY O'RTA TA'LIMIDA SUN'YIY INTELTEKT VA ROBOTOTIKANI O'RGANISH VA O'QITISHGA EHTIYOJNI TAHLILLARI

Annotatsiya

Ushbu maqolada biz O'zbekistondagi umumiy o'rta ta'limda sun'iy intellekt va robototexnikani dasturlashni o'qitishni idrok etish darajasini o'lchash uchun so'rovnoma tadqiqotini o'tkazdik. Biz to'rt guruh ishtirokchilari bilan so'rovnoma o'tkazishni tanladik. Ular umumiy o'rta maktab o'quvchilari (10 va 11-sinf o'quvchilari), ularning ota-onalari, Informatika va axborot texnologiyalari fani o'qituvchilari va maktab direktorlari ishtirok etishga taklif etildi. Tadqiqotga Toshkent shahrida joylashgan 12 ta maktab kiritildi. Har bir respondentning so'rov qog'ozi kodlangan va so'rov natijalari respondentlarning fikri asosida tahlil qilingan.

Kalit so'zlar: Sun'iy intellekt, robototexnika, dasturiy ta'minot.

Introduction. The researchers of the developed countries are conducting various scientific works aimed at developing a number of skills of students, including problem solving, critical thinking and creativity, by implementing the topics of artificial intelligence and robotics within the computer science subject in general secondary education schools. Based on the modern trends of these studies, formation of students' skills to apply the learned knowledge into practice is one of the urgent tasks. Moreover, the implementation of innovative educational technologies in the educational process of general secondary education with the topics of artificial intelligence and robotics in the subject of informatics and information technologies are very important in 21 century. This, in turn, is important for the training of personnel with digital competencies by increasing the interest of students in artificial intelligence and robotics in the general secondary education system of Uzbekistan.

Literature review. Artificial intelligence teaching for K-12 schools has attracted increasing attention among institutions, researchers and educators globally. For instance, the Association for the Advancement of Artificial Intelligence (AAAI) and the Computer Science Teachers Association (CSTA) have collaborated to start AI education for K-12 students in the United States in terms of knowledge representation, machine learning, and AI ethics education [1]. Moreover, the AI4K12.org project aimed to develop guidelines for AI education, which serves as a framework for policymakers and curriculum developers to adopt when developing the essential AI concepts, knowledge, and skills for each grade level. The guideline mentioned the five big ideas in AI including perception, representation & reasoning, learning, natural interaction, and societal impact of AI technologies [2]. In addition, the Massachusetts Institute of Technology (MIT) has developed a suite of AI learning resources, including learning units, hands-on activities, and teacher education guides [3]. Further, the UNESCO Institute for Information Technologies announced an education policy "AI in Education: Change at the Speed of Learning" which describes the advancements in recent technologies including data analytics personalized learning, and machine learning, and explores the promises of AI in education [4]. Despite the fact that these institutions have realized the value of AI education and continued to invest in it at various levels, the design of the AI K-12 curriculum is more complex and lacks standardisation, making it difficult to compare the outcomes among different institutions. Therefore, there is a necessity to explore the recent development in AI education for K-12 schools.

Educators and researchers across countries are working rigorously to develop and explore effective curricula, pedagogy, learning materials, artefacts, systems and tools for their students [5,6,7,8,9,10]. In Asian countries, AI has become an emerging field from research, pedagogical practices, and policies. Due to their strength in the technology industry, countries such as Mainland China, Hong Kong, Japan, Korea and Singapore have launched curricular reforms to address the current movement in AI education.

Research object. The project object is to unveil the potentially interested youth – in school education with suitable appropriate learning environment for AI and robotics. The project intended to cover 12 schools chosen from Tashkent city, Uzbekistan. The mission part of the project is exploring learners' and stakeholders' perceptions on AI and S/W.

Exploring students' and stakeholders' perception on AI and S/W offers valuable information. It uncovers how the intended technologies are understood and accepted by the users. It helps a smooth adoption of the technology into the curriculum.

Students are invited for an interview first and according to the final list of students who are willing to participate, their

parents are also asked for their perceptions.

Current trends of interest and status in the educational system are observed by inviting school leaders and ICT teachers. Their suggestion for the best need for support is necessary.

The development of tailored methodical support is conducted for exploring need analysis. Teacher training, designing suggestions for designing.

The proposed project aims to build, improve and strengthen the education, innovation and transfer capacities of schools in the area of sustainable digitalization and innovative technologies in general and in the area of artificial intelligence in particular. The focus of the project lies specifically in the creation, modification and enhancement of the existing school study programs (mostly S/W programming and AI related topics) with modules that are currently missing in their study programs.

The specific objectives are as follows:

development of new/modernized/updated study program for Informatics and IT;

development of modular components of AI-based study programs and courses (such as Artificial Intelligence, Robotics);

development of new Responsible AI laboratories at each of the participating schools;

capacity building of Informatics and IT teachers for AI and S/W.

Research Methodology. For measuring the perception of teaching and learning of AI and S/W in secondary education in Uzbekistan we chose to take a survey with four group of participants. They are high school students (10th and 11th grade school students), their parents, ICT teachers and school principals. are invited to participate. 12 schools were included for the survey located in Tashkent city. The positive respond for the survey invitation was as follows: 735 students and 542 parents; 33 ICT teachers, and 12 School principals.

Table 1. Number of questions for the two types of items

Question Types	Number of questions for each participant			
	Student	Teacher	Principal	Parent
Education status	3	6	1	2
Necessity and direction of educational support	5	4	9	3
Total	8	10	10	5

Two types of survey items were designed (Table 1): questions indicating the learning and teaching status of AI and S/W (Education status); questions indicating the need for further support (Necessity and direction of educational support). The student survey consists of 8 questions. Parents were asked 5 questions. Teachers and school principals were asked 10 questions each. Observing responses are coded to make analysis.

Coding of respondents

For students: Region-101; Type of respondent-1; Grade-10; Numb-101

Sample:

101111133: Mirobod-101, student-1, 11-11th grade, student number-133 (starting from 101).

10121: Mirobod-101, teacher-2, number-1.

1013: Mirobod-101, director – 3.

1014133: Mirobod-101, parent-4, number 133 (starting from 101).

Analysis and results. Student response from the survey gave the information that currently, student knowledge and comprehension on both programming and artificial intelligence in Uzbekistan is low, about 25% of students reported they have learned independently and other 20% students stated school lessons helped them to grasp the knowledge. Since 50% of students have a surface knowledge and intention to learn from now, the majority of students answered that they had training in different topics, which draws a conclusion as: most students have low level of knowledge or lack of standardized training and have high intention to grasp a practical based training.

The second part of the survey measured the need for support. About 85% of students would participate if there was training 50% and 40% of students showed a great interest in AI and SW respectively.

Since majority 60% of parents expressed satisfaction about overall educational process, a significant number of parents say that their child did not get any training on AI and SW. Learning AI and SW are found preferable face-to-face class settings by using well equipped laboratories. And students believe it benefits their future. These responses closely correlate with parent responses. Parents mostly believe that programming and AI learning positively affect their child's creativity and mastery of other disciplines (285/542). Many parents see programming/AI education as beneficial to their children's future. As can be seen in the "other" answers to questions, there are also some different opinions among parents about the impact and necessity of programming/AI education.

Data shows that while parents have significant levels of support and satisfaction for their children's programming and AI training, there is also a large proportion of those whose children are not involved in these disciplines. It seems that it has a positive effect on both education and future outcomes, helping to integrate programming and artificial intelligence into the child's learning journey.

At the same time, there are some different perspectives and concerns expressed in "other" responses suggest the need to further explore and understand parental perspectives to better address anxiety and enhance programming and AI acquisition among children. However, the information provides valuable insights into parents' attitude to programming and artificial intelligence training for their children, emphasizing the need for continued participation and education about potential benefits.

12 school principals are also invited to take surveys from the same schools. Here is a report based on the school principal's responses for programming and artificial intelligence in education and in school: adequate conditions are created in school with qualified teachers and equipped classrooms: 3/10; partial conditions in different combinations: 4/12, and there are partial conditions have been created, including the provision of qualified teachers, but special classrooms are not sufficiently equipped: 5/12. School interest in teaching programming and artificial intelligence (measure 1-10) yields an average percentage rating: 7.73. Almost all school principals reported that there are different levels of existence of smart constructions, but not enough: 7/12. According to the data, schools suffer from lack of qualified personnel in teaching AI. Collectively, school directors showed willingness to cooperate

with specialized institutions/organizations (12/10). Directors believe the improvement of the skills of teachers in programming and artificial intelligence by development of necessary competencies through training programs.

School principals have a strong interest in teaching programming and artificial intelligence, with an average rating of 7.73 out of 10. However, problems with the availability of resources (such as skilled personnel and equipment) remain.

There is a clear need for an interest in cooperation, efforts to improve the skills of teachers and improved resources, including qualified personnel and the necessary equipment. Directors recognize the importance of providing appropriate infrastructure to enhance teacher experience and effectively train programming and artificial intelligence.

The problems identified indicate the need for targeted activities to address resource shortages and increase teacher capacity, and to ensure the school's interest in providing comprehensive programming and artificial intelligence education.

33 ICT teachers showed willingness to participate who are registered as full time ICT teachers in schools where the survey was taken. They have been asked about their pedagogical skills in teaching AI and SW. They have also expressed their need for methodical facility support in schools. A significant number of teachers reported to include AI and SW in the subject curriculum. Whereas schools include AI and SW in syllabus, there is a lack of student knowledge. This indicates a major demand for methodical support for teacher training and for software/hardware support. Teacher reports claim show lower competence on teaching AI and SW for 10-11 grade. There are very few teachers who can deliver the topics (25% SW and 6% AI) for higher grades. Note that this is only information when middle and higher grades are examined separately.

When it comes to the overall glace, most teachers are fluent in delivering lessons on SW topics only. This is another evidence for a great demand for support for teaching and learning of SW & AI improvement. As the observation shows, many teachers say there are not enough methodical sets for teaching these topics. 31% of teachers report that schools are designed with special classrooms but don't have equipment related to demonstration these technologies like, IoT, robotics, tools for establishing VR.

Conclusion and Recommendations. During the survey we have noticed that most of the students are willing to learn programming and Artificial intelligence within Informatics and Information Technologies course, but because of lack of qualified teacher for these topics there is not enough teaching hours in the subject. Moreover, more rigorous evaluation methods using qualitative and quantitative approaches are necessary for future educators and researchers to understand how they examine students' AI learning performance. A set of implications and recommendations for pedagogical designs in terms of educational standards, curriculum designs, formal/informal education, student learning outcomes, teacher professional development and learning progressions were set up. Additionally, behaviourist theory, cognitive theory, and constructivist theory will be instrumental in addressing AI education. In particular, since learning is recognized to be a social process, involves cognitive thinking, and renders behavioural changes, constructive learning theories and models such as project-based learning, problem-based learning, and inquiry-based learning will better support AI education.

REFERENCES

1. Touretzky, D., Gardner-McCune, C., Martin, F., & Seehorn, D. (2019a). Envisioning AI for K-12: What should every child know about AI? Proceedings of the AAAI Conference on Artificial Intelligence, 33(1), 9795–9799.
2. The Artificial Intelligence (AI) for K-12 initiative (AI4K12) is jointly sponsored by AAAI and CSTA. https://ai4k12.org/ .
3. MIT Media Lab. (2020). Learning about artificial intelligence: A hub of MIT resources for K-12 student. Retrieved from https://news.mit.edu/2020/learning-about-artificial-intelligence-hub-of-mit-resources-k-12-students-0407 .
4. UNESCO IITE. (2020). AI in education: Change at the speed of learning. Retrieved November 14, 2021, from https://iite.unesco.org/wp-con%E2%81%83%20tent/uploads/2020/11/Steven_Duggan_AI-in-Education_2020 .
5. Burgsteiner, H., Kandlhofer, M., & Steinbauer, G. (2016). Irobot: Teaching the basics of artificial intelligence in high schools. In Proceedings of the thirtieth AAAI Conference on artificial intelligence (pp. 4126–4127). AAAI Press.
6. Chai, C., Lin, P., Jong, M., Dai, Y., Chiu, T., & Qin, J. (2021). Perceptions of and behavioral intentions towards learning artificial Intelligence in primary school Students. Educational Technology & Society, 24(3), 89–101.
7. Chai, C., Lin, P., Jong, M., Dai, Y., Chiu, T., & Qin, J. (2021). Perceptions of and behavioral intentions towards learning artificial Intelligence in primary school Students. Educational Technology & Society, 24(3), 89–101.
8. Sensetime. (2018). Fundamentals of artificial intelligence. East China Normal University. Retrieved from ttps://www.sensetime.com/en/Service/ai_class.html
9. Touretzky, D. (2020). Five big ideas in AI" featured in NSF video showcase. Retrieved from https://www.cs.cmu.edu/news/five-big-ideas-ai-featured-nsf-video-showcase
10. Williams, R., & Breazeal, C. (2020). How to train your robot: A middle school AI and ethics curriculum. MIT. Retrieved from https://dam-prod.media.mit.edu/x/2020/06/19/EduAI_2020.pdf