International Journal of Internet, Broadcasting and Communication Vol.12 No.4 232-237 (2020)
http://dx.doi.org/10.7236/IJIBC.2020.12.4.232

IJIBC 20-4-29

Experience Way of Artificial Intelligence PLAY Educational Model for Elementary School Students

Kibbm Lee* and Seok-Jae Moon**

** The master's course, Graduate School of Smart Convergence, KwangWoon University, Seoul, Korea*
*** Professor, Department of Computer Science, KwangWoon University, Seoul, Korea*
e-mail : kibbmcc@kw.ac.kr, msj8086@kw.ac.kr

Abstract

Given the recent pace of development and expansion of Artificial Intelligence (AI) technology, the influence and ripple effects of AI technology on the whole of our lives will be very large and spread rapidly. The National Artificial Intelligence R&D Strategy, published in 2019, emphasizes the importance of artificial intelligence education for K-12 students. It also mentions STEM education, AI convergence curriculum, and budget for supporting the development of teaching materials and tools. However, it is necessary to create a new type of curriculum at a time when artificial intelligence curriculum has never existed before. With many attempts and discussions going very fast in all countries on almost the same starting line. Also, there is no suitable professor for K-12 students, and it is difficult to make K-12 students understand the concept of AI. In particular, it is difficult to teach elementary school students through professional programming in AI education. It is also difficult to learn tools that can teach AI concepts.

In this paper, we propose an educational model for elementary school students to improve their understanding of AI through play or experience. This an experiential education model that combineds exploratory learning and discovery learning using multi-intelligence and the PLAY teaching-learning model to undertand the importance of data training or data required for AI education. This educational model is designed to learn how a computer that knows only binary numbers through UA recognizes images. Through code.org, students were trained to learn AI robots and configured to understand data bias like play. In addition, by learning images directly on a computer through TeachableMachine, a tool capable of supervised learning, to understand the concept of dataset, learning process, and accuracy, and proposed the process of AI inference.

Keywords: *Education, AI experience, Image classification, Machine Learning, Bias*

1. Introduction

In the age of AI, fundamental changes in the job structure will occur. Job changes and job movements are expected to accelerate, with new jobs being created around tasks that require simple, repetitive tasks and creativity. In the past, machines have replaced human physical labor in the process of industrializaion. Now AI has advanced to the level where it performs human intellectual functions. The changes go beyond simple technical dimensions to a paradigm shift that encompasses all fields such as humanities and society[1, 3]. According to 'The National Strategy for Artificial Intelligence' in December 2019, the Korea government said that the preparations for the country and society as a whole are needed in line with this paradigm shift. It

Manuscript Received: October. 19, 2020 / Revised: October. 23, 2020 / Accepted: November. 1, 2020
Corresponding Author: msj8086@kw.ac.kr
Tel: +82-10-7753-8086, Fax: +82-2-916-4751
Professor, Department of Computer Science, KwangWoon University, Seoul, Korea

mentions the importance AI education for primary and secondary school students (K-12)[2].

AI machine learning is different to simple coding. Understanding artificial intelligence requires difficult mathematical concepts or advanced programming skills. However, it is difficult for K-12 to understand AI concepts in that way. There is a Unplugged Activity (UA) method[4] of learning AI concepts without computers, but in some cases it ends up with only theory. According to an in-class survey, some students at K-12 have experienced smart artists such as Alexa and Gini at home or in their surroundings. The way they talk to AI affects algorithms.

In this paper, we propose a model for Artificial Intelligence experience method education for elementary school students to understand the importance of data and data training. This will improve the interest and motivation if learners progress to develop their own strengths among multiple intelligences and complement their weaknesses. The composition of this paper is as follows. Related research of AI education trend, image recognition in Section 2. In Section 3, describe the experiential education model to which the PLAY teaching and learning model is applied to understand the importance or training of image data necessary for AI training. Section 4 describes curriculum application, the model evaluation in Section 5, and finally Section 6 describes the conclusion.

2. Relevant Research

As society changes, public policies related to artificial intelligence must be determined, and digital citizens must know the basics common sense of AI. Computing education and AI education are organized or already operated in the K-12 curriculum[1]. Many attempts and discussions are proceeding very quickly in all countries. The Korea govement announced that it would expand the number of hours for K-12 software and artificial intelligence education by 2022[2]. Recently, the Korean Artificial Intelligence Education Association presented the Framework for AI education[5]. The education to be covered in AI education was presented in three areas: intelligent development, interaction and social impact.

As a landmark event of deep learning in 2012, the image recognition competition (ILSVRC) hosted by imageNet contested how to accurately recognize images by recognizing one million images. Human beings are an easy task to distinguish images intuitively, but a machine without intuition is a very difficult task. As deep learning technology developed, the error rate exceeded 5% in 2015 and fell to 2.3% in 2017. Convolution Neural network (CNN) is a type of artificial neural network used to analyze visual images[6]. Each image pixel is a real number, and a color photograph is three-dimensional data representing each pixel as three real numbers to represent natural colors. In machine learning, feature extraction is essential in order to solve the curse problem that the amount of data required increases in square. CNN extracts low-dimensional features by repeating filtering and sampling, and the filter used here is the optimal filter obtained through learning.

3. Proposed AI Learning Model

This paper presents an educational model for elementary school students to enhance their understanding of AI through play or experience rather than learning expert-level AI concepts or algorithms. The view of AI can be divided into an Engineering approach, a Constructivist approach and a Cognitive approach. The Engineering approach is a view aimed at developing machine devices like human intelligence. Constructivist approach is the view of learning to understand human intelligence in terms of educational utilization, and how to infer and perceive it. The Cognitive approach is the main body of thinking in terms of information education, which values active thinking and cognitive structures that occur inside the human brain. While traditional education metrics of literacy and numeracy are vital, society also requires learners to have a range of holistic skills to thrive in the modern world. In 21st century human talent capabilites, these include technology, creative and innovation, global citizenship skills and interpersonal skills. And today, these skills and knowledge need to be acquired in a more accessible, personalized and active way than ever before.

Thus, the educational model proposed in this paper reflected the view needed to educate AI. This educational model for elementary school students is to improve their understanding of AI through play and experience. This is combinded exploratory learning and discovery learning with PLAY teaching-learning model[7] using multi-intelligence to understand the importance of data trainging or data required for AI education as Figure 1

with 4 steps. The details of step will be discussed in section 4.

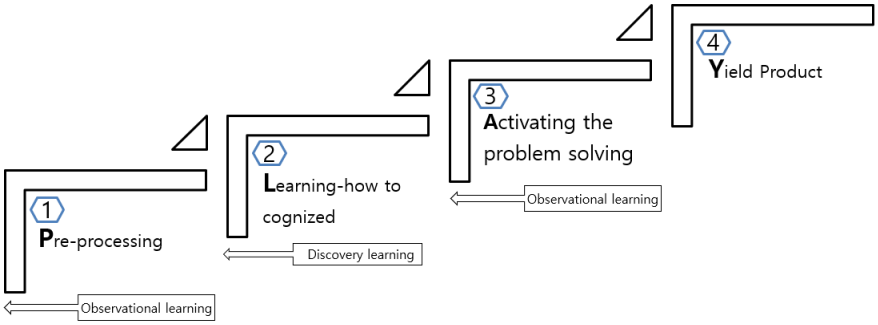
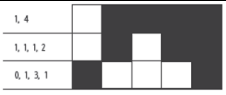


Figure 1. Educational model using PLAY teaching-learning [7]

4. Curriculum Application

AI use cases are presented to elementary school students. The goal is to improve the understanding of AI through play or experience. Instead of recognizing that AI is always right or accurate, students should develop a critical view of information given by AI. Artifical Intelligence is made based on data. So, It has errors or is biased in the data itself, students should be aware that information produced by AI may also be inaccurated and unfair. In this study, it was selected as an image classification subject for elementary students to intuitively check the results.

Table 1. AI curriculum using PLAY teaching-learning

Educational Model	Process	Description	Tool	
Pre-processing	Intro	-Group composition -UA activity **:image representation**	-	
Learning-how to cognized	Experience	**AI for Ocean** - What is Learning? - Pattern recognize - BIAS	Code.org	
Activating the problem solving	Coding	**To make Machine Learning** - step of supervised learning (Gathering-Training-Export)	Teachable Machine	
Yield Product	*Brainstorming and share*	- **AI service Briefing** - Organizing the contents of classes	-	Brainstorming for SDGs subject

As shown in Table1, the curriculum consists of unplugged activity (UA), experience activity, coding to make machine learning, and brainstorming and sharing related to AI.

The class progress is as follows.

- In the Pre-Processing step, the group activities are carried out, and the teaching method is conducted by Observative guidance on image expression.
  - Students are divided by multiple intelligence through a survey.
  - Before learning, share participants's basic understanding of AI.
  - UA to learn how computers that only knows binary numbers recognizes images.
- In the Learning How to Cognized step, individual activies are carried out and the teaching method is perfomed through Discovery guidance on image classification.
  - Experience the image learning courses under the theme of OCEAN, one of the themes of SDGs[10]

through Code.org[8].

- Experience learning AI robots learning like a game and understand pattern recognition and data bias.

- Figure 2 shows Training stage after learning from AI robots whether images are fish or not through Code.org. As the first step of the activity, the learner selects and clicks one of two options:not fish or fish at step1. AI robots are given labels to learn whether they are fish or not at step2. The learner could check training results as step3, in classifies the image entered by the AI robot after learning. Students can make sure that they are good at classifying fish and that the labels have been learned correctly. The stage consists of gathering, training and export stages. If the label is not learned correctly, the student can learn more from the AI robot and if the classification results have been improved.

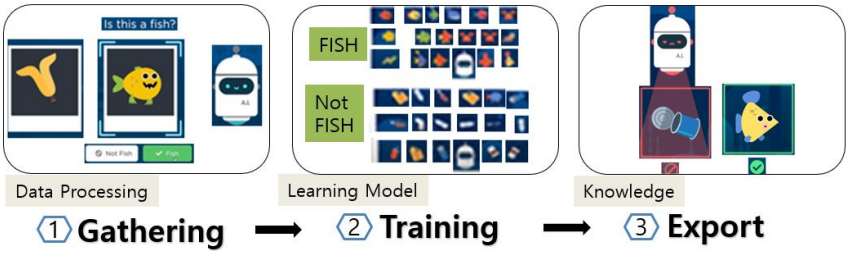


Figure 2. AI robot training through Code.org

- In the Activating the problem solving step, it can be selected as an activity by group or individual and the teaching method is carried out by Ovservational learning.
  - Use TeachableMachine[9] which is a tool capable of supervised learning, to learn the computer directly.
  - Image classification should be learned through Gathering, Training, and Export as a step in supervised learning.
  - During class progress, the data entered should be studied using the presented image, and the test image may be presented or selected by the student themselves.
  - Through the process of creating and testing the learning model by directly entering the dataset, the process of accuracy and AI inference is understood.

- In Figure 3, image classification is the task of predicting what image a computer is trying to test through TeachableMachine. The learner uploads various pictures and labels them as ‘cat’ and ‘dog’, and shows the results through training. Gathering images of dogs and cats with label, then training. Entering the animal test data in Export step will output the probability of the animal being predicted. In general, less data from AI will not give satisfactory results. However, TeachableMachine is pre-trained using MobileNet architecture. It learned in advance through a database called ImageNet, and Transfer Learning by accepting new data.

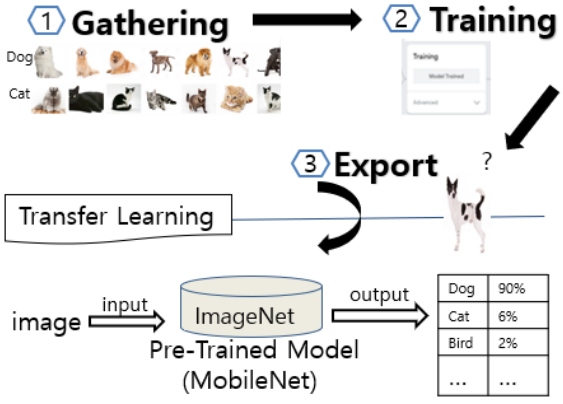


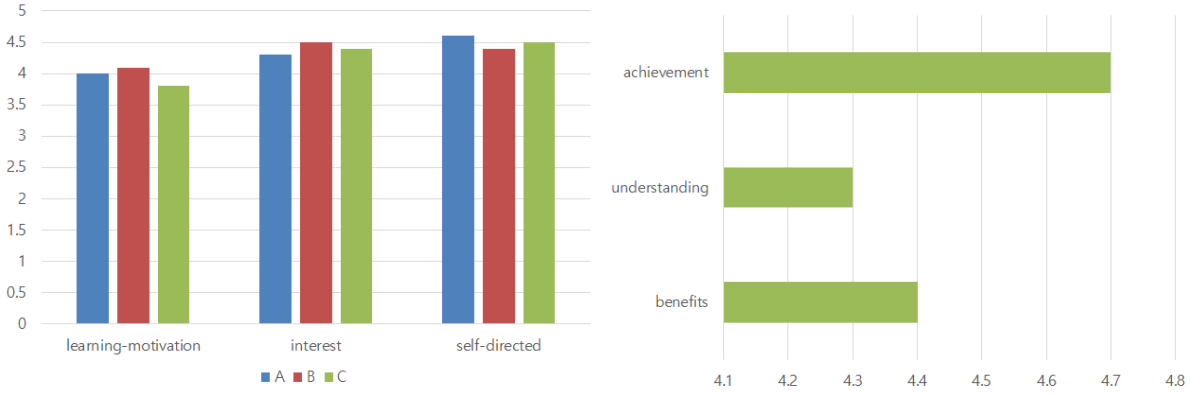
Figure 3. Image classification by Teachablemachine

- In the Yield product stage, as a group activity of the PBL method, the problem solving of Substainable Development Goals (SDGs) is presented in relation to AI.
  - Problem solving of SDGs is presented in relation to AI. The SDGs or Global Goals are a collection of 17 interlinked goals designed to be a “blueprint to achieve a better and more sustainable future for all. The SDGs were set in 2015 by UN and are intended to be achieved by the year 2030. The SDGs pay attention to multiple cross-cutting issues, like gender equilty, education and culture cut across all of the SDGs. It often used as the subject of global citizenship[10].
  - Brainstorming that can benefit humans and world using AI.
  - Establishing common target topics and discussing with the group members, going through the process of Self-recognize and understand.
  - In addition, AI service Briefing is carried out by organizing opinions of group members and sharing with the entire group.

5. Educational Model evaluation

At the beginning of class, in order to measure the cognitive level of AI, students were asked to write words that remind them of AI with open questions. There were other opinions depending on learners, such as vague fear, not knowing about AI, or other opinions that were not directly related to me and often heard in the news, but were not particularly memorable. Through the tests according to the multiple intelligence questions, they identified three main intelligences of their won, and were configured to be able to move to any group they wanted to choose from.

The learner’s satisfaction test is a numerical value that indirectly looks at the class applicaility and interest of the AI experience program and the understanding of AI lerning concepts and algorithms[4, 7]. The class satisfaction test consists of 6 questions and 2 open questions using Likert scale 5 point.



(a) **(b)**

Figure 4. (a) Achievement, understanding and benefit
Figure 4. (b) Learning motivation, interest and self-directed learning ability

Figure 4(a) shows analysis results for motivation, interest, and self-directed learning ability by dividing it into groups for each intelligence. The satisfaction analysis showed that learners actively participate. The higher the motivation for learning, the more interesting the results were compared to other groups. Figure 4(b) shows analysis results for achievement, understanding, and benefits. Overall, the average was 4.0 or higher, making a poitive evaluation. Also, it showed that they were satisfied with AI learning by showing other friends’ recommendation and willingness to re-engage in learning. In fact, it was difficult to understand the internal algorithms for Supervised Learning and Transfer Learning by providing data based on the result in Pre-Trainning. However, it achieved an average high achievement of 4.7, which can confirm the results while actually experiencing it.

Table 2. Evaluation of other educational models

	Information education as PLAY model	AI education as Unplugged Activity(UA)	AI education as AI Experience PLAY model
Self-directed	0.867	0.884	0.887
Achievement	0.940	0.822	0.940
Beneficial	0.765	0.912	0.880
Interest	*0.968*	0.868	0.880

This following Table 2 is analyzed by other educational models and items. The comparison items are interest, benefit, achievement rate, and self-direction. Other educational models include AI education as Unplugged Activity, and Information education as PLAY model. It showed self-directed and beneficial are high in UA and AI experience PLAY model. And, Achievement rate is higher than AI education as UA due to result verfication and success experience.

6. Conclusion

In this paper, the necessity and flow of AI education for elementary school students was identified, and an AI experience education model was sought. This study applied a curriculum developed with 12 students in the fifth and sixth grades of elementary school, analyzing the validity and satisfaction, the students' satisfaction was positive. It was found that the AI education program can be applied in the field through the UA approach and the use of AI experience tools. Based on my research, we would like to suggest AI education as an experiential way for learners to understand more intuitively. AI education should be learner's personal internal factors affects academic achievement. Right now, we don't have the basic AI literacy skills. We don't know what K-12 AI education should look like, so there is an opportunity to really shape it.

We suggest that they should do it in a direct way, that students should be able to work and share ideas as part of groups and communities. Also suggest that they should be empowered with tools to create projects that are important to them. Although the necessity of AI education in schools is increasing, access to overseas platforms is low due to the absence of domestic AI education platforms. AI education should be able to understand technology rather than difficult and difficult technical approaches, and develop the core competencies of the essential aspects of human beings that AI machines cannot. Thus, more research should be done on AI curriculum and educational models that can develop human relationships, abilities such as mutual cooperation, personality, sensivity, etc.

References

[1] AI4K12.org (2019). "Learning Activities for Teaching AI in K-12"
[2] Ministry of Science and ICT (2019). "Artificial intelligence national strategy announced"
[3] Kim, Kapsu, and Youngki Park. "A development and application of the teaching and learning model of artificial intelligence education for elementary students." Journal of The Korean Association of Information Education 21.1 (2017): 139-149.
[4] Kim, Jungah, et al. "The Effect of Education Data Visualization using Unplugged Program on the Computational Thinking of Third Grade Students." Journal of The Korean Association of Information Education 23.4 (2019): 283-292.
[5] Kim, Soohwan, et al. "Review on Artificial Intelligence Education for K-12 Students and Teachers." The Journal of Korean Association of Computer Education 23.4 (2020): 1-11.
[6] Deshpande, Adit. "A beginner's guide to understanding convolutional neural networks." Retrieved March 31.2017 (2016).
[7] Ho-Kyun Park, Kibbm Lee and Seok-Jae Moon. "Learning Method of Software Education based on PLAY Teaching-Learning Model." The Society of Convergence Knowledge 6.1 (2017): 119-125.
[8] Code.org: *https://studio.code.org/s/oceans*
[9] TeachableMachine: *https://teachablemachine.withgoogle.com/*
[10] UN. SDGs *https://sustainabledevelopment.un.org/sdgs*