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Research Article

Using Machine Learning to Enhance Interaction and Creativity Among Children By Using The Scratch And Mblock Programming Languages and Many Different Kids' Machine Learning Platforms For Designing A.I Programs

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Abstract

Artificial intelligence (AI) and machine learning (ML) technologies have experienced substantial growth in the last decade, affecting billions of individuals across all facets of contemporary life. This trend of AI's expanding influence is expected to persist. The increasing significance of AI and ML in computer science and society supports the integration of AI and ML principles at an early stage.ML can be made more approachable and interesting for children by utilizing beginner-friendly kids' programming languages like scratch. We design models for incorporating machine learning techniques using scratch and mblock programming languages to recognize images and text. These models are created using web-based cloud service tools such as "Machine Learning for Kids" and "teachable machine," as well as programming using Scratch 3 programming language and mblock programming language. The proposed methodology is introduced to 5th and 4th grade classrooms in Alhijragroup education in Iraq through provided practical exercises involving the creation of models that can recognize images and text. The survey shows that the best practices for incorporating machine learning into 5th grade classrooms are so that students can actively participate in their own learning and develop their own unique ideas for artificial intelligence (A.I) programs using different platforms. Alhijragroup education students are familiarized with the concept of machine learning through the summer course provided to them by IOTKIDS Company in Iraq. The survey shows that the F parameter is confidence which means every increase in the importance of artificial intelligence (the independent axis X) is linked to a similar increase in the quality of education (the dependent axis Y). The correlation between the two axes is very strong. These output modules are designed by using a special computer equipped with GPU memory Nividia Geforce RTX 2060 6G, IBM SPSS Statistics and Microsoft Excel 2010 programs.

1. INTRODUCTION

Computer science, coding abilities and computational thinking are increasingly being incorporated into educational curricula globally[1].Over the course of the previous decade, the field of artificial intelligence (AI), specifically machine learning, has experienced significant and rapid growth, establishing itself as one of the most rapidly advancing sub-disciplines within the realm of computer science. This expansion has yielded substantial implications for a vast number of individuals, reaching into the billions[2][3]. While there has been significant focus on undergraduate and graduate education in AI, the introduction of AI by IOTKIDs in Iraq highlights the crucial role of AI in computer science and society. IOT Kids is a prominent initiative in Iraq that aims to educate children in coding, robotics, artificial intelligence, and electronics. The objectives are to instruct children in the appropriate use of contemporary technology, mitigate its adverse impacts, and facilitate the acquisition of new proficiencies such as logical reasoning and invention. The IOT KIDS provides a range of online courses for children aged 5 to 15 years in game design, robotics, programming, electronics and artificial intelligence. We have the largest community in Iraq for children and currently operate in 9 different cities across the country. IOT KIDS is an educational company that introduces an online platform for kids aged 7-15 by offering STEM educational programs including Programming, Robotics, Electronics, 3D Modeling, and Artificial Intelligence [4]. The main objective of the study is to improve the student's self-efficacy and foster their interest in computer science, specifically in the fields of machine learning and artificial intelligence (ML/AI). This experience has the potential to inspire a greater number of students to study computer science through academic courses, hence increasing the likelihood of them pursuing jobs in computer science and machine learning. The study methodology seeks to generate novel insights into following enquiries:

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1- How viable are the “machine learning for kids” and “teachable machine” environments as tools for delivering online training in data gathering, training machine learning models, and utilizing the models to develop applications in scratch and mblock programming language.
2- We enhance the vocabulary of the scratch and mblock programming languages to enable the creation of machine applications because there are only a limited number of methods that have been created to offer a clear and uncomplicated comprehension of machine learning specifically aimed at children our study can be further extended and explored by other researchers.
3- How exposure to machine learning can enhance children’s enthusiasm for creating artificial intelligence programs.
4- Does the implementation of machine learning result in students developing more favorable perception of computer science and artificial intelligence applications?

2. Related Work

There are only a limited number of methods that have been created to offer a clear and uncomplicated comprehension of machine learning specifically aimed at children or high school students.

Jorge Pacheco et. al. introduced a paper that seeks to elucidate the potential of artificial intelligence and its correlation with computational thinking (CT) within an educational framework, specifically involving a 9^{th} grade class from the 3^{rd} cycle of basic education at a public school on the island of S. Miguel. This investigation is conducted through a machine learning activity centered on the renowned game rock paper scissors, utilizing the AI platform and tool, machine learning for kids (ML4K). This case study employs a qualitative technique that identifies AI and machine learning as resources for the advancement of CT. The study’s results indicate that the incorporation of AI themed fosters innovative ideas and enhances knowledge among students, hence facilitating their comprehension of fundamental concepts in computational thinking(CT) [5].Ibrahim cetin presents a study to investigate the impact of modality (constructionist mBlock, scratch, and python interventions) on sixth-grade students’ computational thinking, programming attitude, and achievement. The study’s results indicated that the mBlock group surpassed the scratch and python groups in terms of computer programming mindset. Students who participated in mBlock and scratch groups exhibited superior programming achievement compared to those in the python group.no notable disparities regarding computational thinking were detected among the groups[6]. Chan-Jin Chung et al. outlines a methodology for introducing machine learning to K-12 pupils by use of an online summer camp. The students are familiarized with the concept of machine learning through practical exercises involving the creation of applications that can recognize sounds, text, images, numbers and video data. This is achieved using a web-based cloud service tool called “Machine Learning for kids” in conjunction with the scratch 3 programming language and lego mindstorms EV# robots[7]. Nora Alturayeif et al. introduces deepscrach, an extension to scratch that allows elementary and middle school students to comprehend and create deep learning applications with the use of sophisticated language features [8]. Nicolas Pope et al. introduced methods for instructing young students in the concepts and operations of machine learning (ML) and data-driven computing systems. In addition to the design process, they introduce the GenAi teachable machine, a new tool. This visual data-driven design platform is an excellent resource for teaching newcomers the fundamentals of machine learning, particularly as it pertains to classifiers. [9]. Ken Kahn et al. has created materials to allow beginners to construct artificial intelligence applications such as speech recognitions, audio synthesis, and image identification, in the block-based language snap [10]. There aren’t many systems out there that can offer an uncomplicated comprehension of data science and machine learning designed for use by elementary and secondary school pupils. Community blocks for scratch, designed for data science [11].

3. METHODOLOGY

The tools being contemplated for the children were: Teachable Machine is a Google tool that enables users to train and evaluate machine learning models without the need for coding. Conversely, teachable machine is a somewhat conceptual tool does not provide explanations for fundamental machine learning topics such as hyper parameters, algorithms, and assessment measures. Scratch is a graphical programming platform that enables users to acquire computer programming skills while engaging in projects that involve multimedia elements, such as interactive narratives, games, and animations. Scratch is primarily intended for individuals between the ages of eight and 16, although it is also utilized by individuals of all age groups. One of the main objectives of scratch is to facilitate self-directed learning through experimentation and collaboration with peers[12].

Mblock is a coding platform specifically created to offer an enriched educational experience to all students. Users can start by learning block-based programming and gradually progress to mastring the python language, all using the same platform. Furthermore, students have the opportunity to explore advanced technologies like machine learning and internet of things, in addition to mastring widely-used programming language. They can also extend their programming skills to other advices beyond the digital realm [13].

Machine learning for kids is a teaching tool that allows children to learn how to program a computer to recognize different types of data, such as text, images, numbers or noises. Teaching children about AI and ML is the primary objective of machine learning for kids. This free tool introduces machine learning by providing hands-on experiences for training machine learning systems and building things with them. The platform offers a user –friendly and directed setting for training machine leaning models to identify and classify text, images, numbers and sounds. This initiative expands upon current endeavors to introduce and educate children in coding by incorporating these models into educational coding platforms scratch and eduBlocks. It assists children in developing projects and constructing games using the machine learning models they have trained. The tool was initially introduced in 2017 and is currently being utilized by numerous educational institutions, coding clubs, and households worldwide. Dale lane is constructing that tool using IBM watson's API[14][15].

Scratch programming language is graphical programming platform that enables users to acquire computer programming skills by working on projects that involve many forms of media, such as interactive animations, games and tales. Scratch is specifically created for individuals between the age of 8 and 16, however it is utilized by individuals of all age groups. One of the main objectives of scratch is to facilitate self-directed learning by encouraging experimentation and collaboration with peers. Sound and graphics can be imported in scratch using the included paint tool, sound recorder and camera [16][17].

4. The proposed projects

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable. During our visit to Alhijra School, after briefly explaining the basics of machine learning, some proposed projects were presented to the students that showcase the concept of using machine learning in artificial intelligence applications. The proposed survey was distributed to 40 students in the fifth primary stage, ages ranging from 10 to 11 years. The questionnaire consists of two questions, the first axis is "the importance of using artificial intelligence" and the second axis is "creating a spirit of interaction and creativity for children in the educational process" and each axis consists of 10 questions. The projects types as following:

A. Text recognized

We used a pretrained machine learning model provided by the "machine learning for kids" tool.We created two categories of data, one group "sad" that contains sad words and the other "happy" that contains happy words, then trained the pre-trained model. This code was written with scratch programming language and the online tool "Meachine Learning for Kids."First, the student needs to train a model with some text using the online machine learning for Kids tool. The proposed model creates two classes, happy and sad as seen in figure(1), with each class input fourteen words that point to the sad in class sad and point to the happy in class happy like "careless, nervous, stupide, aggressive and miserly " for the sad class and "nice, gently, shy ,loyal and beautiful" for happy class. Second, write the code with scratch programming language and recall the pre-trained happy-sad model to use to test new text as shown in figure (2). The user of the program puts a comment for the computer; the proposed model must recognize if it is a good or bad comment and show a happy or sad face depending on the comments, as shown in figure (3).

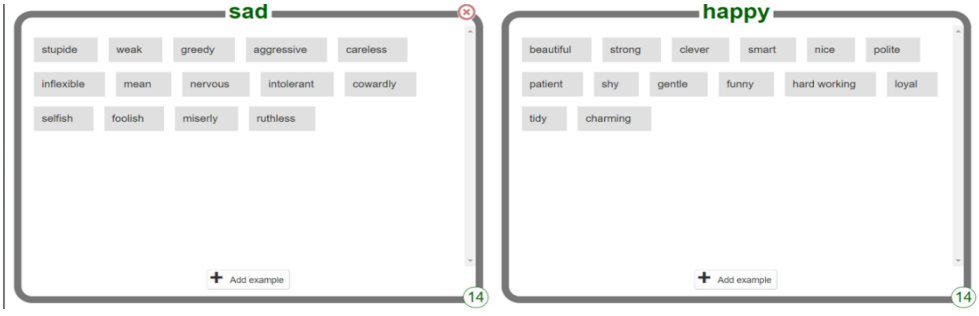


Fig.1 Text recognized model classes

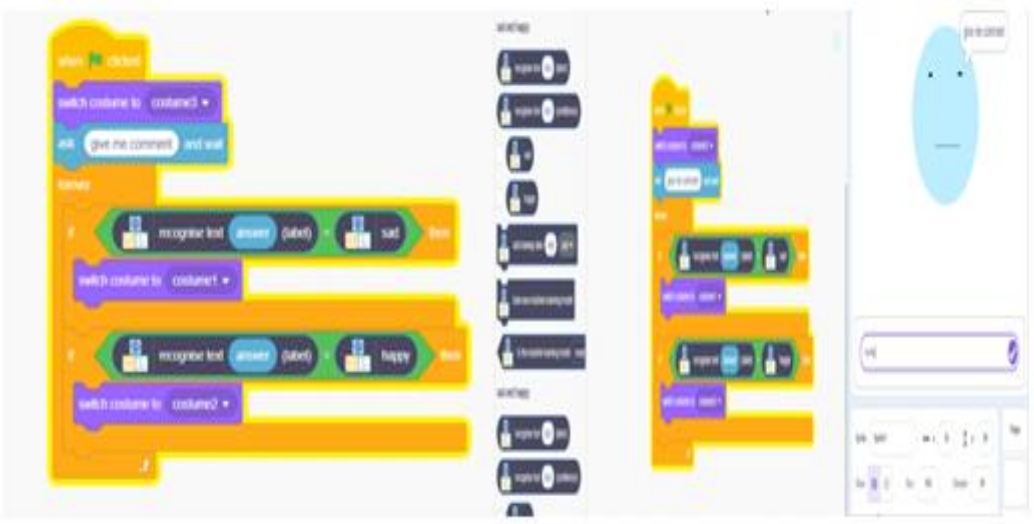


Fig.2 Text recognition script

Fig.3 The output face

B. Pose detection

The suggested "pose project" model, developed using the Google tool "teachable machine," consists of three distinct classes: T pose, Spartan pose, and chicken pose. The proposed detector uses a computer's webcam to capture the pose of youngsters, enabling the creation of a real-time detector. When inputting a group of children posing to train the model, as depicted in figure (4), the model is then tested immediately to determine if it accurately classifies new examples. The model categories the stances as Spartan pose, T pose, or chicken pose, as shown in figure (5). The first image is classified as a Spartan image, the second image is classified as a Tpose image, and the third image is classified as a chicken image

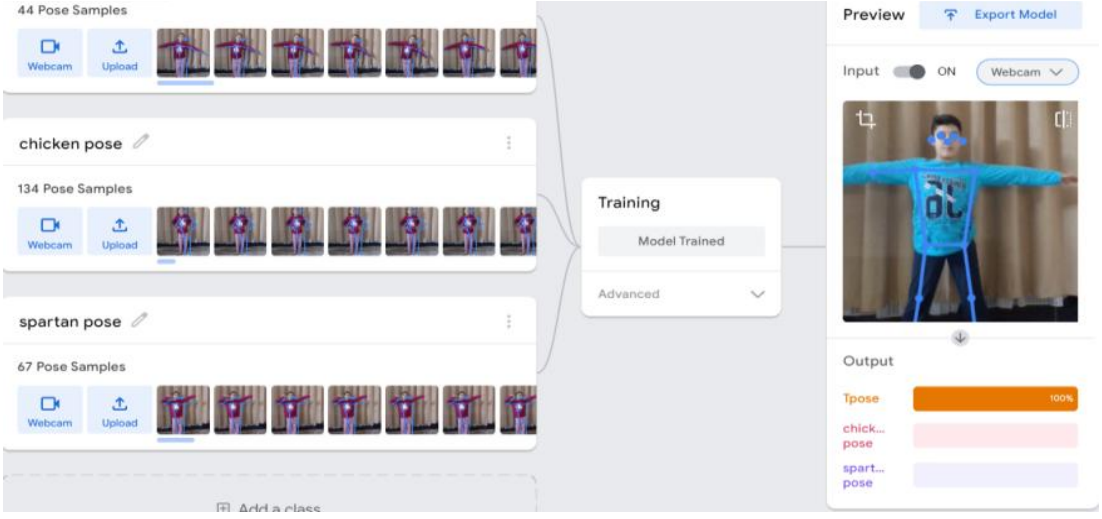
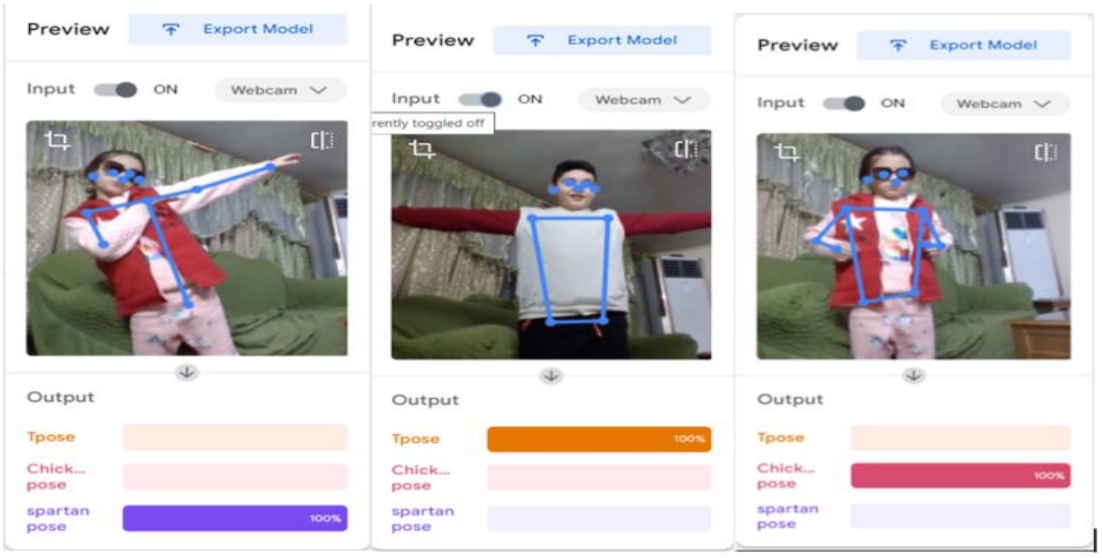


Fig. 4. Training image model



a.spartan pose image b.Tpose image c.chicken pose image

Fig 5. The tested output image

C- Emotion detection

The proposed program is designed to create an AI robot to detect human emotion using a computer camera and the Mblock programming language. First, change the sprite to robot, and click on the extension to add cognitive services in the Mblock programming language. The cognitive services provide more sounds, images, and knowledge functions for sprites, which allow have more fun with stage programming. Then write the following code as appeared in figure (6). The computer's live camera captures the person and feeds him into the machine learning model AI robot. The AI robot detected a human face smile or laughs it say happy as shown in figure (7).

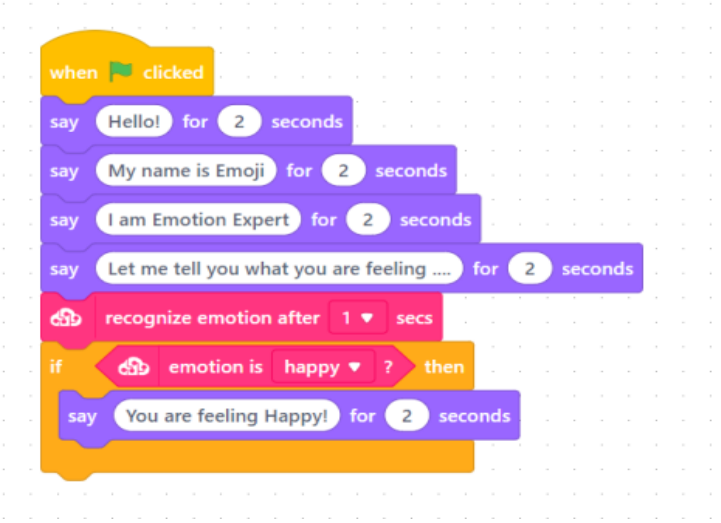


Fig. 6 The proposed emotion detector MBlock scripts

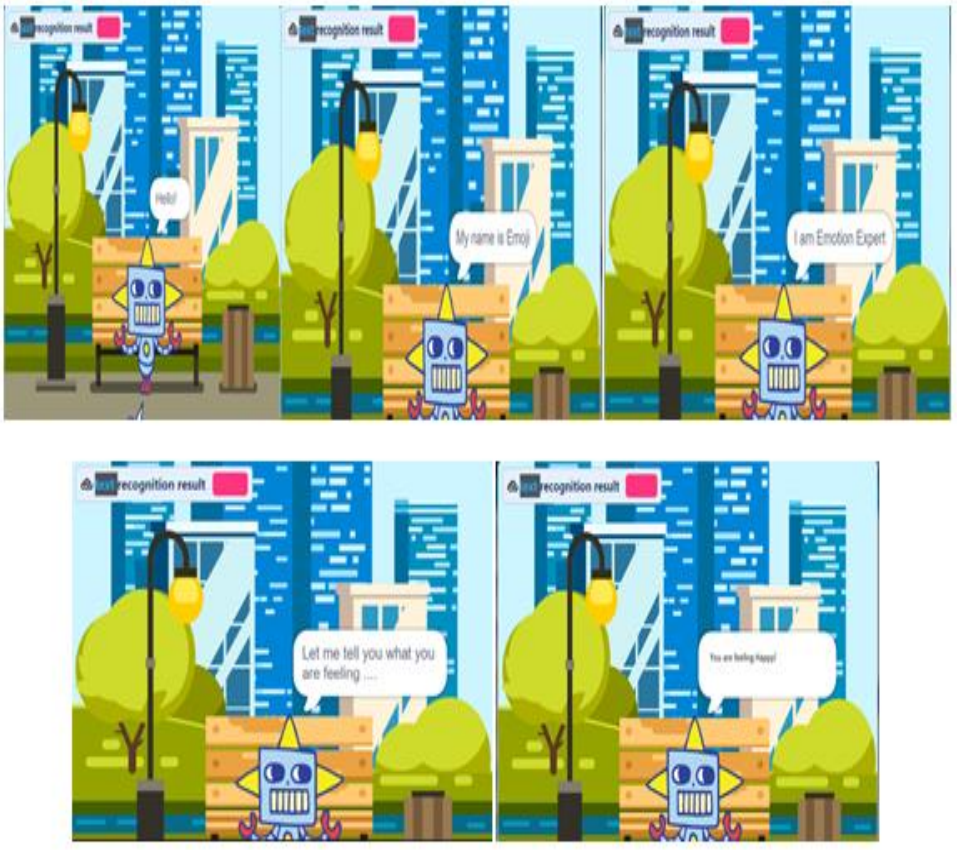


Fig. 7 The Proposed robot detector

5- RESULTS

This section provides a comprehensive analysis of the data obtained from a questionnaire that was issued to 5th grade classrooms at Alhijragroup education. The survey was distributed to 40 students in the fifth primary stage, ages ranging from 10 to 11 years. The questionnaire consists of two questions, the first axis is "the importance of using artificial intelligence" and the second axis is "creating a spirit of interaction and creativity for children in the educational process" and each axis consists of 10 questions as appeared in table (1).We analyzed the children's responses using five-point likert scale as appeared in Table(1).The mean, standard deviation and coefficient of variation were employed to assess the children's experiences and perspectives. The output result as appeared in table (1) and Table (2) computed using Microsoft excel 2010 and IBM SPSS Statistics program.

$$M = \frac{\sum x}{n} \ldots\ldots\ldots\ldots\ldots\ldots (1)\ [18]$$

M is mean, N is the number of students (40) and x is the value of each answer of question according to likert scale

$$\sigma = \sqrt{\frac{\sum (X-M)^2}{N}} \ldots\ldots\ldots\ldots (2)\ [19]$$

Where the σ is standard deviation , N is the number of students (40) and x is the value of each answer of question according to likert scale

$$CV = \frac{\sigma}{M} * 100 \ldots\ldots\ldots\ldots\ldots (3)\ [20]$$

Was the CV is the coefficient of variation, σ is standard deviation and M is the mean.

TABLE I. THE RESULT OF QUESTIONS ACCORDING TO 5-POINT LIKERT SCALE

Coefficient of variation	Standard deviation	mean	Strongly disagree	disagree	neutral	agree	Strongly agree	paragraph	Seq.
	First axis (X): The importance of using artificial intelligence								
0.37	1.44	3.88	6	1	4	10	19	Artificial intelligence provides systems that give computers the ability to think, see, hear, and move	**.1**
0.33	1.29	3.93	4	1	7	10	18	Artificial intelligence systems are characterized by a wide range of information processing and deductive thinking	**.2**
0.33	1.35	4.08	3	4	4	5	24	There are many educational platforms that support artificial intelligence, providing children with many educational courses and workshops	**.3**
0.34	1.32	3.83	3	4	8	7	18	Introducing children to an advanced level of artificial intelligence, such as machine learning	**.4**
0.30	1.24	4.20	3	1	6	5	25	It is necessary to teach children the basics of artificial intelligence because they will become future leaders	**.5**
0.32	1.27	3.98	4	0	8	9	19	The cost of providing robots and replacing them with designing artificial intelligence programs	**.6**
0.30	1.20	4.05	2	3	6	9	20	Artificial intelligence is seen as a tool to fill the needs and shortcomings in current education	**.7**
0.23	1.06	4.52	2	1	2	4	31	Artificial intelligence develops means of entertainment for children, such as entering the world of virtual reality and other means of entertainment for children	**.8**
0.34	1.31	3.85	3	3	10	5	19	Ease of training and testing the machine learning model designed by children	**.9**
0.33	1.34	4.12	4	1	6	4	25	Enabling the child to learn about the digital world and artificial intelligence under the supervision of parents	**.10**
0.32	1.44	4.53							
			The second axis (Y) :Creating a spirit of interaction and creativity for children in the educational process,						
0.28	1.17	4.15	2	2	6	8	22	Introducing children to the scientific foundations of information technology and what it offers in the educational field, such as a computer or mobile phone with educational programs	**11**
0.33	1.27	3.85	3	3	8	9	17	Training children on how to extract information from the Internet	**12**
0.36	1.39	3.85	4	4	5	8	19	Guiding children to integrate into the world of programming through the programming languages designated for them	**13**
0.29	1.22	4.18	3	0	8	5	24	Students interacted with programming languages for children, such as Scratch and Mblock	**14**
0.34	1.29	3.80	4	1	10	9	16	Traditional teaching methods usually generate boredom and a lack of desire to learn on the part of children	**15**

0.22	0.95	4.38	1	0	7	7	25	To create a spirit of interaction and competition among children, periodic competitions are held among a group of children remotely using the Internet	**16**
0.31	1.24	4.00	3	2	6	10	19	Developing the child's ability to self-learn through electronic platforms	**17**
0.21	0.91	4.30	1	0	6	12	21	Ease of dealing with online educational platforms for children	**18**
0.31	1.23	4.02	3	2	5	11	19	Preparing children and preparing them to deal with electronic transactions, as the whole world is moving towards electronic governments	**19**
0.28	1.13	4.05	2	0	12	6	20	The process of developing a child's creativity starts from an environment rich in influences through the use of scientific programs and methods	**20**
0.32	1.39	4.38							

Through the above results, as appeared in table (1), it was found that the average mean response rate to the independent variable axis (the importance of using artificial intelligence) was (4.53) with a standard deviation of (1.44). The paragraph (8), which states "Artificial intelligence develops entertainment for children, such as using it in the world of virtual reality and other entertainment for children," obtained the highest mean (4.53) and standard deviation (1.06) with a coefficient of variation of (0.23), while the lowest mean for this axis was (3.83) and standard deviation. (1.32) with a coefficient of variation (0.34) in paragraph (3), which states: "Introducing children to an advanced level of artificial intelligence such as machine learning". As for the axis of the dependent variable (Y), the average mean for this axis was (4.38) with a standard deviation of (1.39). Paragraph (16) of the axis paragraphs (creating a spirit of interaction and creativity in the educational process) occurred, which states (to create a spirit of interaction Competition among children: periodic competitions are held between a group of children remotely using the Internet) with the highest mean (4.38) and standard deviation (0.95) with a coefficient of variation (0.22), while the lowest mean for this axis was (3.80) and standard deviation (1.29) with a coefficient of variation (0.34) in Paragraph (15), which states: "Traditional teaching methods usually generate boredom and a lack of desire to learn on the part of children."

TABLE II. THE RELATIONSHIP BETWEEN TWO PROPOSED AXIS'S OF SURVEY

Type of correlation	P(Sig)	F value	T value	β coefficient	R Square	R	The Dependent Variable
Simple correlation	**0.000**	**97.606**	**9.880**	**0.848**	**0.720**	**0.0848**	**Y**

The table (2) above displays the R and R^2 values. The degree of correlation is denoted by R value, which in this case is R = 0.848 (as seen in the "R" column), indicating a high degree of correlation. The R^2 number, also known as the "R Square" column, quantifies the proportion of the total variation in the dependent variable(y) that can be accounted for by the independent variable (x). The value of 0.720 provides a substantial explanation 0f 72%. In our study, we utilize the T-value as a metric to measure the appropriateness of variables. The independent variable (x) had a significant influence on the dependent variable (y), with a magnitude of 9.880. The p-value quantifies the (probability) possibility of observing a variable's influence by chance alone, aiding in the determination of its statistical significance. The F-value obtained is 97.606, and the related p-value is 0.000, indicating an extremely small value. We compare the p-value to the alpha level (usually set at 0.05). If the p-value is less than 0.05 as we founded (0.00< 0.5), it indicates a statistically significant relationship between the independent variable and the dependent variable. A look at the coefficient table's 'B' column reveals the values of the regression line's intercept and gradient. A significance test is performed on the gradient (β).the line's gradient would be 0 if no relationship exists. The value of the gradient (β) in our study is 0.848. Through the results obtained, we find that the statistical model is reliable and that the value of B is 0.848. This means that every increase in the first axis (the importance of artificial intelligence) is associated with a similar increase in the second axis (the quality ال of education).ال

6. CONCLUSION

Machine learning is a subfield of artificial intelligence, is a computational approach that facilitates the acquisition of knowledge by systems through the analysis of data. Its primary objective is to identify patterns and make informed decisions without the need for explicit programming. This study investigates the potential of machine learning (ML) to inspire kids to work to gather and think outside the box when developing AI applications for different platforms. Our goal is to provide a stimulating learning environment that encourages computational thinking and problem-solving abilities. And creative expression among learners by introducing them to ML principles and tools optimized for these needs. This study offers valuable insights into the most effective ways to incorporate machine learning into early childhood education by comparing the efficacy of several educational platforms in teaching children about artificial intelligence. However, there is a need for greater awareness of how to employ advanced concepts such as machine learning in age-appropriate ways. It is recommended that artificial intelligence be integrated with traditional methods, that teachers and children be provided with prior training, and that a focus be placed on interactive entertainment such as virtual reality and educational competition, which received the highest ratings. The statistical results strongly support the validity of the study's model and provide a strong foundation for expanding research in this area.

Conflicts of Interest

No conflicts of interest have been identified by the author, according to their disclosure statement.

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