Correlation between Digital Badge Certification and Teachers' Behavior in the Era of Artificial Intelligence

Hexia Yao[1,2,a,*], Elizabeth M. Sagubo[1,b]

[1]*College of Teacher Education, University of the Cordilleras, Baguio, Benguet, Philippines*
[2]*Student Affairs Department, Hebei University of Engineering, Handan, Hebei, China*
[a]*hexiayao73@163.com, [b]emsagubo@uc-bcf.edu.ph*
*Corresponding author

Abstract: Digital badge certification is a display of personal ability, and teacher behavior is a two-way behavior including teaching and learning. This paper has aimed to investigate specific research algorithms in the age of artificial intelligence (AI). The selected artificial neural network (ANN) related algorithms are used to research and analyze the related performance of digital badge certification and teachers' behavior, so that the two can be better combined and serve the education industry. This paper has analyzed the ANN-related algorithms, and conducted in-depth research on digital badge authentication and teacher behavior, so as to apply the algorithm to the questionnaire analysis of the two. Based on the experiments in this paper, it is known that a questionnaire survey was conducted on 194 primary and secondary school teachers in City H. Combined with the analysis of teachers' attitudes towards digital badge certification; it is known that teachers believe that the inadequacy of digital badges is mainly reflected in three dimensions. Among them, there are 65 teachers who agree that the utilitarianism is too strong and the description of personal values is lacking, and 64 teachers think that the evaluation system is difficult to unify. The experimental results of this paper have shown that using ANN as the basic method to study the correlation between digital badge authentication and teachers' behavior can obtain more scientific experimental data, and has developmental significance for the development of education and the growth of students and teachers.

1. Introduction

AI is a fast-growing intelligent technology with strong development momentum. Its rapid development path represents a huge progress in the Industrial Revolution. Due to the super ability of AI to classify information and process data, it can widely serve the current life and promote the continuous innovation of human civilization and technology. This paper has combined the artificial neural network method in AI to analyze the relationship between the two, in order to expand the exploration of the internal relationship between digital badge certification and teacher behavior, so as to provide a feasible direction for the combination of AI algorithm and teacher behavior. Digital badge certification and teacher behavior are the research hotspots in the age of intelligence, and

there are many scholars discussing them. Ngoc L T has recognized that routing services in mobile Ad Hoc network (MANETs) typically deny service to targets of an offensive nature. Therefore, it is necessary to take appropriate methods to improve the security performance of routing services, and to provide digital certificate verification services more adaptively [1]. Rohan A J's research mainly has combined digital badges with online courses to help learners familiarize themselves with business processes and provide effective methods for seeking developmental needs such as nursing coordination [2]. Alexander J H has believed that digital badges are a major innovation of traditional badges. When used in the field of teaching, they can enhance students' enthusiasm for learning and pay attention to teachers' mental health, so as to promote students' acquisition of knowledge and skills. The purpose of the experiment is to promote the health education of adolescents [3]. Noakes S has thought that social media would affect teachers' words and deeds, and has explored whether relevant social media policies in Australia violate teachers' personal life and privacy rights, so as to make certain efforts for teachers' freedom of life [4]. Brey J R's research mission has been to explore the relationship between classroom environment, teacher behavior and students' physical education. Through the evaluation of students in 6 schools, the obtained data were processed by descriptive statistics, and the correlation between classroom environment and teacher behavior was obtained [5]. The combination of the two has been a research direction in recent years. However, there are few studies, and less research on teacher behavior in combination with intelligent algorithms.

Many new technologies have been derived from the AI era, and many scholars have studied them. Hassabis D has already believed that AI has a long history, and neuroscience and its collaborations have a long history of progress. However, for some reason, the connection between the two is not close. Based on long-term research experience, neuroscience and AI are still considered to be the key to future research [6]. Krittanawong C has believed that AI, as an important research field of computer science, can be widely used in cardiovascular medicine to assist in the exploration of new research methods of diseases [7]. Buczak A's research has mainly focused on machine learning and data mining, and discussed the challenges of the two for network security maintenance, thus giving some auxiliary suggestions [8]. Jiang C has believed that the development of new wireless networks needs to improve their own adaptive learning and decision-making capabilities [9]. Chen J H has thought that when training data, in order to accurately judge its prediction of future clinical decisions, a new clinical order recommendation system has been established [10]. The era of AI is full of various scientific technologies and intelligent algorithms. Many scholars have applied them to real-world research, but they are less used to study the relationship between digital badge certification and teacher behavior.

Based on the perspective of the AI era, this paper has discussed the correlation between digital badges and teachers' behavior, and used the specific algorithm of artificial neural network to mine experimental data to obtain practical conclusions. The innovation of this paper is that based on the related algorithms of artificial neural network in deep learning, this paper has analyzed the practical significance of the correlation between digital badge certification and teacher behavior performance.

2. Specific Method of Artificial Intelligence in Digital Badge Certification and Teacher Behavior Performance

2.1 Digital Badge Authentication

Digital badges are generated based on paper certificates, and their performance surpasses paper certificates. It can be transplanted and verified through certain big data methods, and can establish a unique connection with users without interference from other factors [11-12]. Digital badge

certification is a display of personal achievements. It breaks through the limitations of traditional resume static symbols and paper certificates. It can share its own achievements on the platform in a shared browsing method, which can enable users to gain more attention. Digital badges are essentially an effective indicator of learners' real emotional status and achievements, and can provide learners with a convenient learning space [13-14].

2.2 Teacher Behavior & Artificial Intelligence

AI is a discipline that expresses and uses knowledge. In essence, it is an intelligent machine that can simulate human intelligent thinking and behavior [15]. In the field of production, more cheap robots can be created to liberate human labor; it can enhance human ability to understand and adapt to the world. However, for the application of AI, both the scientific community and the public call for application in the field of promoting human development [16-17]. AI is not human intelligence, but has infinite possibilities and creativity, and can even surpass human intelligence in some aspects. Figure 1 shows the main application areas of AI:
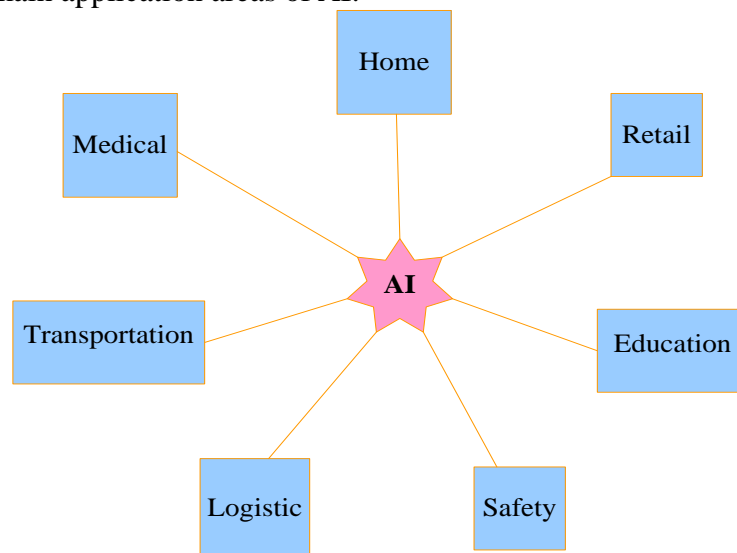

Figure 1: Main application areas of AI

The available intelligent means in the AI era are very rich. In order to better combine the digital badge authentication proposed in this paper with teacher behavior performance, this paper takes deep learning as the starting point, and selects artificial neural network (ANN) as the main research method of this paper.

According to relevant literature, ANN is a new computational model established by imitating the human neural network in biology. It can store knowledge information in the network according to the way humans deal with problems and learn knowledge, and continuously adjust through learning to obtain the final result, which can be used to deal with practical problems [18].

The artificial neuron is a processing unit belonging to the neural network, and its basic components include: connection weights (referring to the corresponding weights of the input signal entering the neuron model. A positive weight value indicates that the neuron is in an activated state, and a negative value indicates that the neuron is in an inhibited state); summation unit (referring to the linear combination in the network); nonlinear activation function (referring to a weighting that needs to satisfy the input signal and exceeds the threshold y_n, so that the output neurons can be within a certain range). The specific model is shown in Figure 2:
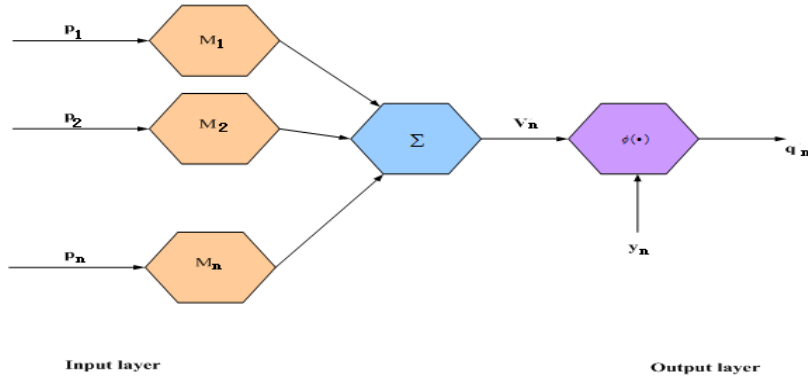
Figure 2: Simple model of neuron

Figure 2 shows a simple neuron model with multiple input values but with only one output value. Among them, $P = (p_1, p_2, \cdots p_k)^T$ represents the input signal value, and the connection weight of the neuron is represented by $M = (m_1, m_2, \cdots m_k)^T$. v_n represents the weighted sum of the input signals, and y_n represents the threshold. $\phi(\bullet)$ represents the activation function, and q_n represents the output signal.

Therefore, there are:

$$v_n = \sum_{i=1}^{a} m_{ni} p_i$$

(1)

$$q_n = \phi(v_n - y_n)$$

(2)

The activation function $\phi(\bullet)$ can nonlinearly map the difference between the weighted value of the input signal and the threshold value y_n. Among them, q_n is the representative output signal. The activation function can be represented as follows:

The threshold function is:

$$\phi(u_n) \begin{cases} 1, u_n \geq 0 \\ 0, u_n < 0 \end{cases},$$

(3)

The output signal is:

$$q_n \begin{cases} 1, u_n \geq 0 \\ 0, u_n < 0 \end{cases},$$

(4)

Among them, $u_n = v_n - y_n$.

The piecewise function is:

$$\phi(u_n) = \begin{cases} 1, u_n \geq 1 \\ \dfrac{1}{2}(1 + u_n), -1 < u_n < 1, \quad u_n = v_n - y_n \\ 0, \ u_n \leq -1 \end{cases}$$

(5)

The sigmoid function is:

$$\phi(u_n)\frac{1}{1+e^{-\alpha u_n}} \tag{6}$$

Among them, $\alpha(\alpha>0)$ represents the slope. Since the sigmoid function has always been regarded as a sigmoid function, it is more common in the ANN excitation function, but the output value needs to be controlled, which is between [0, 1].

The hyperbolic tangent function is:

$$\phi(u_n)\frac{1-e^{-u_n}}{1+e^{-u_n}} \tag{7}$$

In practical applications, the output result would contain positive and negative results. Generally, this function is used to replace the S-function, and its output value needs to be controlled at [-1,1].

According to the connection mode of neural network, its structure includes feedforward type and feedback type. The former means that in the process of learning the network, single-item propagation is required and no feedback is accepted while the latter, as a connected network with interoperability, can perform forward propagation and back propagation. However, according to the actual functions of the two, when performing pattern recognition or function approximation, the former can be selected, and the latter is mainly used for associative memory and seeking the optimal solution.

The learning methods of ANN are mainly divided into supervised and unsupervised learning. The ANN learning process is a process of continuously adjusting its own network parameters. Generally, it adjusts its own parameters according to the given input and output data, combined with the specific error operation method, or directly calculates the system parameter values according to the given requirements. The following is a demonstration of common algorithms:

Error correction learning algorithm

At the moment of k, there are n neurons entering the network $p_n(k)$. The nth input is $p_n(k)$ and its expected output is $d_n(k)$. Its actual output value is $q_n(k)$, and the error signal is $e_n(k)=d_n(k)-q_n(k)$. Since the actual output value needs to be close to the expected output value, a function with the error signal $e_n(k)$ as an independent variable is set, which is generally called an objective function, and this value needs to be the minimum value. Thus, the process of error correction learning is transformed into a process of seeking an optimal solution.

The common objective function is:

The feedforward neural network contains linear threshold units: the network model is decomposed into several units, and each group of units contains 1 neuron and connected adjustable weights. Multilayer feedforward network is composed of three types of neural layers, which can be used to solve nonlinear separable problems. BP algorithm is a back-propagation algorithm.

The linear threshold unit:

In any linear threshold unit, the input is a k-dimensional variable, and the output is a j-dimensional variable.

The formulas can be expressed as:

$$p_l \in R, P=(p_1,p_2,\cdots p_k)^T \tag{8}$$

$$m_l \in R, M=(m_1,m_2,\cdots m_k)^T \tag{9}$$

If

$$u = \sum_{i=1}^{a} m_i p_i - \theta = m^T p - \theta$$

(10)

among them, $\theta \in R$ is the threshold, then $q = \text{sgn}(u)$.

3. Experiment of Digital Badge Certification and Teacher Behavioral Performance

The purpose of this experiment is to investigate the relationship between primary and secondary school teachers' digital badge certification and teachers' behavioral performance in City H. A questionnaire was designed to understand the teaching status of teachers, in order to explore the relationship between them, and corresponding strategies were proposed in the analysis.

3.1 Scheme Design

This experiment was mainly conducted in the form of a questionnaire, and was designed and analyzed around digital badge certification and the behavior of teachers of different ages, different teaching ages, different subjects and different genders. This questionnaire was designed with the Chinese and mathematics teachers of primary and secondary schools in City H as the experimental objects, and the relevant cognition of teachers was designed, with a total of 7 questions. Due to the tight spare time of teachers, the content of the questions in this questionnaire is very simple, which can facilitate teachers to answer quickly and avoid teachers answering questions in order to complete the task, which reflects the authenticity of the questionnaire in some aspects. A total of 200 questionnaires were distributed to primary and secondary school teachers, of which 100 were distributed to middle schools and 100 to primary schools. A total of 194 were recovered, with an effective rate of 97%. The basic information of teachers is shown in Table 1:

Table 1: Reference table for teachers' basic information (teaching age)

|	Under 10 years	10-20 years	More than 20 years
Male	30	25	18
Female	52	38	31
Total	82	63	49

It can be seen from Table 1 that among the 194 primary and secondary school teachers who participated in the questionnaire, 82 are teachers with less than 10 years of teaching experience, including 30 males and 52 females. It can be seen that the proportion of female teachers is higher than the number of male teachers.

3.2 Results of Evaluation

For the relevant questions set by the questionnaire, the specific analysis content is shown as follows.

(1) Understanding of digital badge certification

Based on relevant literature analysis, in order to clearly explore the relationship between digital badge certification and teacher behavior, it is necessary to clarify teachers' understanding of digital badge certification. The specific situation is shown in Figure 3:
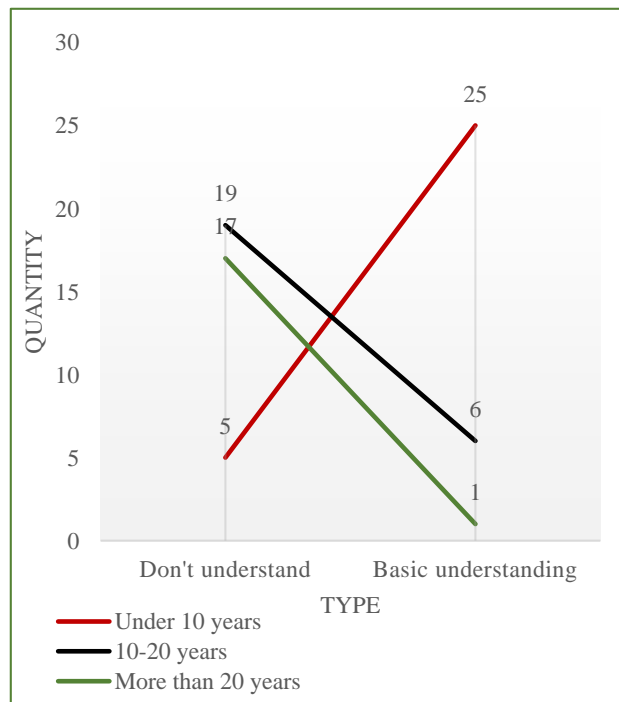
(a) Male teachers' awareness of digital badge certification
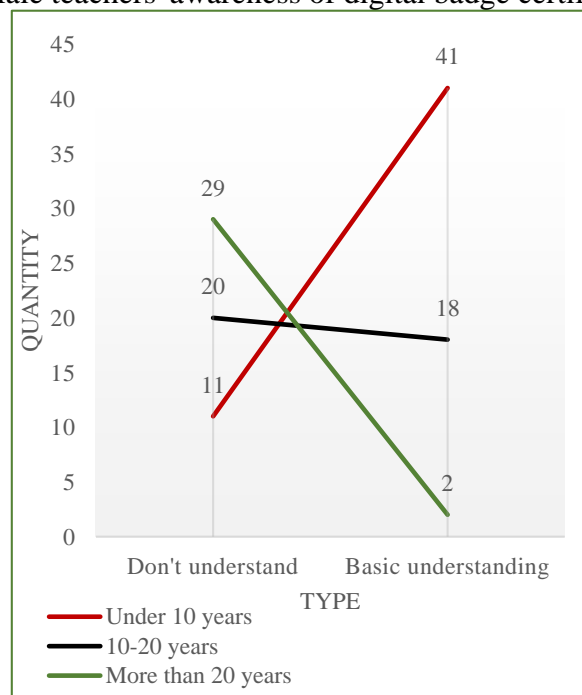
(b) Female teachers' awareness of digital badge certification

Figure 3: Teacher awareness of digital badge certification

According to Figure 3, it can be seen that male and female teachers' awareness of digital badge certification varies greatly. In Figure 3(a), there are 41 male teachers who do not know about digital badges. There are 61 female teachers who have a basic understanding of digital badge certification. Among them, there are 41 teachers with less than 10 years of teaching experience, 18 teachers with teaching experience of 10-20 years, and 2 female teachers with more than 20 years of teaching experience. To sum up, it can be seen that the proportion of young teachers who are aware of digital

badge certification is higher than that of teachers with longer teaching experience, because young teachers have a higher awareness of intelligent information products.

(2) Attitudes towards digital badges and traditional qualifications

Looking at the relevant literature, it can be seen that digital badge certification is actually a certification of personal ability, which is the result of the development of traditional qualification certification. Therefore, it is very important to explore the predispositions and attitudes of primary and secondary school teachers towards digital badges and traditional qualifications. The details are shown in Table 2:

Table 2: Teachers' tendentious attitudes towards digital badge certification versus traditional qualifications

	Male	Female
Recognize Traditional Qualifications	25	45
Neutral	20	17
Identity Digital Badge Certification	28	59

According to Table 2, the number of teachers who prefer digital badge certification is the largest, followed by the number of teachers who prefer traditional qualification certification. Fewer people are neutral. This is because among the interviewed teachers, 82 teachers have less than 10 years of teaching experience, indicating that the proportion of young teachers among the interviewees is relatively high, and they are more able to accept intelligent products.

(3) The role of digital badges

To further explore the interaction of digital badges and teacher behavior, it is necessary to further understand the specific role of digital badges, and to understand what kind of progressive role digital badge certification can bring to teachers. The details are shown in Table 3:

Table 3: The role of digital badges

	Male	Female
Stimulate learning motivation	32	42
Support self-directed learning	27	45
Support lifelong learning	14	34

According to Table 3, the functions of digital badges mainly include the following three types: stimulating learning motivation, supporting independent learning and supporting lifelong learning. Therefore, it is used as a teacher to motivate learning motivation, and it is more important to recognize the importance of digital badges to evaluate process learning. Since the digital badge is mainly completed through the learner's autonomy and self-discipline, and can satisfy the learner to enter the field of interest for learning, its self-learning ability is also highly recognized.
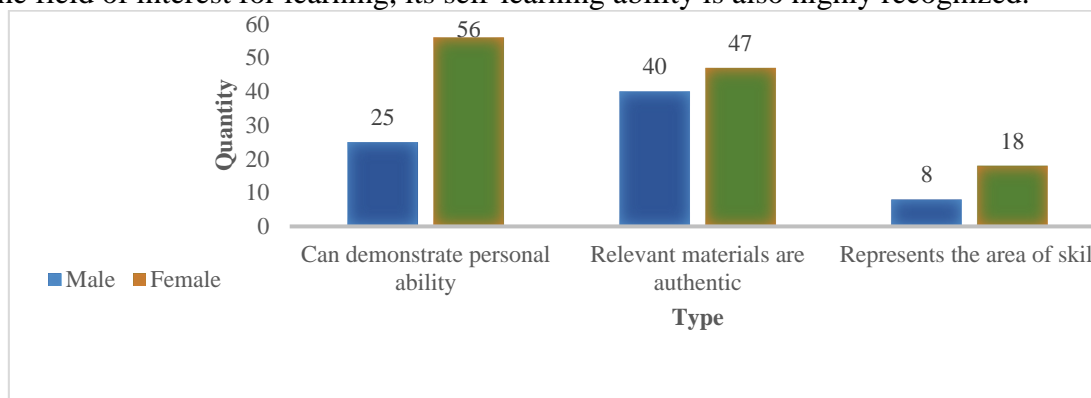

Figure 4: Reasons why teachers are willing to use digital badges for certification

(4) Reasons why teachers are willing to use digital badges for certification

Exploring the reasons why teachers are willing to use digital badges for certification has important reference significance for analyzing the relationship between digital badges and teacher behavior. The specific situation is shown in Figure 4:

According to the questionnaire, the main reasons why teachers are willing to use digital badges for certification are the following three points: they can demonstrate their personal abilities; the information provided is authentic and credible; they can reflect the field of acquired skills. To sum up, the main reason why teachers choose digital badges for certification is that they can show their personal abilities and provide real background information, so that students, parents and peers can pay attention to their personal values.

(5) Inadequacy of digital badges

The development of digital badge certification is still in the early stage of development, and there are many shortcomings. In order to better study its relationship with teachers' behavior, it is necessary to clearly point out its shortcomings and make improvements. The deficiencies of digital badges are shown in Table 4:

Table 4: Weaknesses of digital badges

	Male	Female
Strong utilitarian	28	37
Inadequate description of personal values	24	41
It is difficult to unify the evaluation system	21	43

According to Table 4, the shortcomings of digital badges are mainly reflected in the following three aspects: too utilitarian, lack of description of personal values, and difficulty in unifying the evaluation system. Among them, there are 65 people who agree with being too utilitarian. There are 28 males and 37 females. The lack of a description of personal values is also not uncommon, at 65. There are 24 males and 41 females. There are 64 teachers who believe that the difficulty of unifying the evaluation system is the main deficiency of digital badge certification. Among them, 21 are male and 43 are female. Overall, there is not much difference in the number of people who agree with the three reasons for deficiency, indicating that these three reasons are the main difficulties that need to be overcome for digital badge certification to sustain long-term performance of teachers.

3.3 Meaning Evaluation Based on AI Background

Based on the above analysis, it can be seen that AI can be well linked to the research on the correlation between digital badge certification and teacher behavior. This paper mainly explores the relationship between digital badge certification and teacher behavioral performance. Therefore, the experiment on 194 primary and secondary school teachers in City H can clearly reflect the practical significance of combining the research object of this paper with the AI background. Because of the high proportion of young teachers, the teachers in this experiment are more likely to accept the use of digital badge certification to carry out teaching plans. Through the analysis of teachers' cognitive attitudes towards digital badge certification, the combined developmental significance of the research on the correlation between digital badge certification and teachers' behavior performance is finally obtained.

4. Conclusion

Combined with the analysis of this paper, it can be seen that digital badge certification is mainly used to evaluate and display the learning status and learning ability of learners. Teacher behavior refers to teachers' teaching behavior on the one hand, and teachers' learning behavior on the other

hand. It can be clearly seen in this article that the discussion should be on the acquisition of teachers' learning ability, and of course the improvement of some teaching ability is also involved. Because digital badge certification is an accelerator for the transformation of educational assessment, it can be applied to teachers' learning process. It can also be applied to the teaching process of teachers. While the teacher's own learning attitude is motivated, it can also be transformed into his own encouragement method, which can be applied to the classroom teaching process to avoid the rigid and outdated mode of traditional teaching. At this level, teachers need to dig deep into the positive motivational connection between students and digital badges, and stimulate students' external learning motivation, thus promoting the teaching and learning relationship between teachers and students. The combination of digital badge certification and teacher behavioral performance is a future research direction. In particular, the teaching requirements such as formative evaluation proposed by the current education policy are very necessary. Therefore, its combination with the AI background is also the development trend of the current intelligent era.

References

[1] Ngoc L T, Tu V T. A Digital Certification Management Mechanisms and Security Routing Protocol in Mobile Ad Hoc Network. Journal of Computer Science and Cybernetics, 2018, 34(3):199-217.

[2] Rohan A J, Fullerton J, Escallier L A, Pati S. Creating a Novel Online Digital Badge-Awarding Program in Patient Navigation to Address Healthcare Access. Journal for Nurses in Professional Development, 2017, 33(3):106-112.

[3] Alexander J H, Neill S. The psychosocial impact of NHS Digital Badges on a school-aged cohort: Journal of Child Health Care, 2018, 22(4):619-630.

[4] Noakes S, Hook S. The blurred line between the professional and the personal: Regulation of teacher behaviour on social media: Australian Journal of Education, 2021, 65(1):6-23.

[5] Brey J R, Suga A, Silva A, Aez C. Class context, teacher behavior, and physical activity levels during physical education classes. Journal of Physical Education, 2021, 32(1):1-15.

[6] Hassabis D, Kumaran D, Summerfield C, Botvinick M. Neuroscience-Inspired Artificial Intelligence. Neuron, 2017, 95(2):245-258.

[7] Krittanawong C, Zhang H J, Wang Z, Aydar M, Kitai T. The Present and Future: Artificial Intelligence in Precision Cardiovascular Medicine. Journal of the American College of Cardiology, 2017, 69(21):2657 – 2664.

[8] Buczak A, Guven E. A Survey of Data Mining and Machine Learning Methods for Cyber Security Intrusion Detection. IEEE Communications Surveys & Tutorials, 2017, 18(2):1153-1176.

[9] Jiang C, Zhang H, Yong R, Zhu H, Chen KC, Hanzo L. Machine Learning Paradigms for Next-Generation Wireless Networks. IEEE Wireless Communications, 2017, 24(2):98-105.

[10] Chen J H, Asch S M. Machine Learning and Prediction in Medicine — Beyond the Peak of Inflated Expectations. New England Journal of Medicine, 2017, 376(26):2507-2509.

[11] Amano K, Tsuzuku S, Suzuki K, Hiraoka N. Designing a Digital Badge as a Reflection Tool in Blended Workshops. Journal of Information & Systems in Education, 2017, 16(1):12-17.

[12] Geier M T. The Teacher Behavior Checklist: The Mediation Role of Teacher Behaviors in the Relationship Between the Students' Importance of Teacher Behaviors and Students' Effort: Teaching of Psychology, 2022, 49(1):14-20.

[13] Wu D, Chen J, Deng W, Wei Y. The Recognition of Teacher Behavior Based on Multimodal Information Fusion. Mathematical Problems in Engineering, 2020, 2020(1):1-8.

[14] Dewaele J M. The Effect of Classroom Emotions, Attitudes toward English, and Teacher Behavior on Willingness to Communicate Among English Foreign Language Learners. Journal of Language and Social Psychology, 2019, 38(4):523-535.

[15] Du Y, Xie L, Zhong J A, Zou H, Law R, Yan X. Creativity fostering teacher behavior on student creative achievement: Mediation of intrinsic motivation and moderation of openness to experience:. School Psychology International, 2019, 40(5):525-542.

[16] Purba D E, Supriyatin S, Sigit D V. The Relationship between Students' Perceptions of Interpersonal Teacher Behaviour with Students' Biology Outcomes. Biosfer Jurnal Pendidikan Biologi, 2018, 8(2):14-19.

[17] Apak J, Taat M S, Suki N M. Measuring Teacher Creativity-Nurturing Behavior and Readiness for 21st Century Classroom Management. International journal of information and communication technology education: an official publication of the Information Resources Management Association, 2021, 17(3):52-67.

[18] Muslida D, Firman F, Riska R. Disciplinary Behavior and Exemplary Teacher as Influencing Factors. Jurnal Aplikasi IPTEK Indonesia, 2020, 4(2):95-100.