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Modeling and Analysis of TPACK Ability and Training of Primary School Teachers Integrating Information Technology in the Context of Mobile Internet

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Abstract. In order to improve the information teaching ability of primary school teachers, this paper studies the cultivation of primary school teachers' TPACK ability by integrating information technology under the background of mobile Internet, and proposes a data processing algorithm for online teaching teachers' TPACK ability. According to the algorithm differences of these three coding strategies, this paper proposes the differences of these algorithms and the applicability of distributed storage systems in practical applications. In addition, this paper also proposes an experimental model to analyze these differences. According to the characteristics of the three coding algorithms, several important parameters to measure the performance of the coding algorithm are proposed, and a TPACK ability training model for primary school teachers is constructed. Through the experimental research, we can see that the TPACK based primary school teachers' informatization teaching ability training model can help primary school teachers improve their informatization teaching ability.

Keywords: mobile internet; Information technology; Primary school teachers; TPACK capability; train.

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1 INTRODUCTION

Teachers' indispensable abilities in teaching can be divided into five kinds, namely integrated learning, teaching implementation, teaching evaluation, teaching design and teaching research. In the process of online teaching, teachers should strive to achieve the integration of technology and subject content, so that technology and teaching activities can be effectively combined. Compared with traditional teaching methods, online teaching not only has specific functions, but also can summarize knowledge points in terms of structure and find the connection between each knowledge [1]. The application of TPACK framework is an important part of realizing online teaching ability to form a comprehensive ability system. In the teaching process, teachers' teaching integration ability can also be highly comprehensively presented on the basis of the application of TPACK framework, and this content also occupies an important position in the online teaching structure, and is the basic content of online teaching ability. In fact, the most important thing about online teaching ability is to enable teachers to apply advanced information technology to teaching, so that teachers can reflect the knowledge structure in teaching to students more concretely. It not only improves the teaching level of teachers, but also helps students to learn better [2].

Pay attention to the application of information technology in teaching. In order to further improve the online teaching ability of middle school teachers, they need to be proficient in the application of information technology. In the actual teaching process, teachers can use advanced information technology and corresponding knowledge to achieve the improvement of teaching quality, and this is also the purpose of helping teachers to improve the level of online teaching [3]. At the same time, teachers can also subtly cultivate students' creativity and practical ability in the teaching process, and at the same time can increase their information literacy, so as to achieve students' all-round development. In addition, teachers can be organized to carry out corresponding training for the courses according to the relevant theoretical content of teachers' learning. To this end, schools should build an effective teaching platform, so that teachers can use the platform to offer courses, use information technology to create fluid and dynamic teaching, and optimize teaching quality and teaching methods [4].

The TPACK framework emphasizes how to present the knowledge in the discipline more intuitively. This puts forward new requirements for teachers, and it is necessary for teachers to conduct research on how information technology is integrated into the presentation of subject content, and at the same time, show the changes in the classroom in a more complete way [5]. The use of information technology can more flexibly display the rigid knowledge content in the subject, reduce the difficulty of learning knowledge for students, lead students to understand the connotation of knowledge, and ultimately help teachers improve the quality of teaching. At the same time, the school also needs to encourage some outstanding teachers to open courses, and for some outstanding teachers, the school can regularly organize young teachers to conduct teaching observation, and regularly conduct training on online teaching technology and other related content, so as to help them improve online teaching. Curriculum application ability and design ability [6]. In addition, it is also necessary to help them equip with some corresponding platforms for counseling and consulting services, so that they can also invisibly improve the level of technical application in their usual work [7].

Informatization teaching ability is one of the important contents in the field of educational technology research, and many scholars have expounded the necessity and importance of informatization teaching ability from a different perspective. Combined with the practice of distance education, we believe that the informatization teaching ability of distance education teachers is the comprehensive practical ability displayed by distance education teachers when they engage in distance education teaching, and it is the core ability that teachers need to engage in distance education teaching in the information technology environment. It is also a key factor for teachers to implement information-related content into all aspects of distance education teaching [8].

The TPACK knowledge framework includes three levels of knowledge, namely TK, PK, CK basic layer knowledge, PCK, TCK, TPK development layer knowledge, and TPCK integration layer knowledge. Development provides a comprehensive reference. Knowledge is the content of teachers' learning. Only when teachers learn, internalize and integrate relevant teaching knowledge can they show their superb teaching ability. Teaching ability is transformed from teaching knowledge, and teaching ability depends on the construction of teaching knowledge [9]. One of the basic components in the TPACK knowledge framework is TK, which highlights the importance of technical knowledge. The TPACK knowledge framework requires subject teachers to use pedagogical methods to package and disseminate subject knowledge with the support of technology [10].

In the practice of distance education and teaching, teachers should actively use information technology to carry out distance teaching, fully realize the importance and necessity of using information technology to transmit distance education teaching concepts and subject knowledge, and establish the establishment of continuous learning of new technologies and new A lifelong learning attitude of skills and new knowledge; in the practice of distance education and teaching, they can consciously abide by national laws, regulations and moral norms, be strict with themselves, fully implement the fundamental task of morality and cultivating people, and guide students to use information technology in a rational and standardized manner. Internet words and deeds can cultivate students' good pro-social behavior [11].

According to the TPACK knowledge framework, distance education teachers should fully master the subject knowledge, pedagogy-related knowledge, and information-based teaching related knowledge of the subjects they teach, and try their best to integrate and master all elements, master the subject teaching knowledge and methods of integrated technology, and master the teaching methods. The knowledge and methods of distance education teaching; distance education teachers should be able to complete the relevant operations of distance education teaching management, be able to skillfully use various types of distance education equipment, be familiar with the operation of distance education platforms, master the operation of distance education software, and be able to use information technology to complete Teaching information retrieval, processing, dissemination, management and other work [12].

Distance education teachers should have the ability to design distance education teaching, be able to combine the characteristics and needs of online learning of adult learners, reasonably determine the course teaching objectives, choose appropriate teaching strategies, make full use of information technology, create different subject teaching modes, and improve the quality of teaching. Students are interested in learning and create an efficient online classroom with a strong learning atmosphere; in the practice process of distance education teaching, distance education teachers can deeply integrate information technology and curriculum, take students as the center, design teaching tasks, carry out teaching activities, pay attention to and The interaction of students, pay attention to the communication with distance education peers and managers, so as to achieve timely feedback and achieve the improvement of distance education teaching quality and excellence [13].

Distance education teachers fully understand the necessity and importance of distance education evaluation, and can use information technology to pay attention to students' learning process, evaluate students' learning performance, and give students feedback and guidance in a timely manner. Distance education teachers can make an objective summary and evaluation of their own distance education teaching behavior, timely reflect on teaching, improve and adjust distance education teaching words and deeds; they must fully grasp the innovation opportunities brought by information technology to distance education, and be good at using new Technological means create and innovate the teaching mode of distance education, enhance the vitality and vitality of distance education; timely summarize the practice, rise to modern distance education theory, improve teachers' personal scientific research literacy, and promote the development of distance education [14].

Based on the four levels of distance education teachers' informatization teaching ability structure based on TPACK, the informatization teaching process of distance education teachers can be divided into three stages, namely perception stage, practice stage and innovation stage. The perception stage corresponds to the awareness and responsibility of information-based teaching. In this stage, more attention is paid to the cultivation of distance education teachers' teaching awareness and responsibility. The cultivation of awareness and responsibility runs through teachers' careers and is long-term and pioneering. Only with the awareness and responsibility of informatization teaching ability can there be follow-up teaching practice and innovation [15]. The acquisition of information-based teaching ability awareness and responsibility covers all elements of the TPACK knowledge framework. Distance teachers need to improve not only the awareness of independent knowledge elements, but also the awareness of composite elements based on technical support. Only in this way can they adapt to modern. The needs of distance education development [16].

This paper studies the TPACK ability training of primary school teachers combined with mobile Internet technology, and explores a reliable method to improve the TPACK ability of primary school teachers.

2 TPACK ABILITY DATA PROCESSING OF ONLINE TECHING TEACHERS

2.1 Research on the Performance of Erasure Code Algorithm

The model established in this paper is based on the following assumptions:

1. The computing and storage capabilities of each node in the distributed storage system are the same; the system has not been maliciously attacked; the operating environment in which the distributed storage system is located is stable and reliable.

2. The entire distributed storage system has n storage servers for data storage. The distributed storage system has m storage servers for storing original data blocks, then the number of storage servers for storing check data blocks is n-m. According to the reliability requirements of the system, the number of check blocks should be above a certain value.

3. The storage server uses m' encoded data blocks to restore the original data, where m≤m'≤n.

4. In a distributed storage system, if a coded data block is damaged, it cannot be used to restore the original data, that is, the coded data blocks used to restore the original data in the system are all correct, and there is no tampered data.

2.1.1 Model Description

A raw data is decomposed into m original data blocks of equal size, and each original data block is divided into a set of w-bit encoded words, and encoding and decoding operations are performed in units of encoded words, as shown in Figure 1.

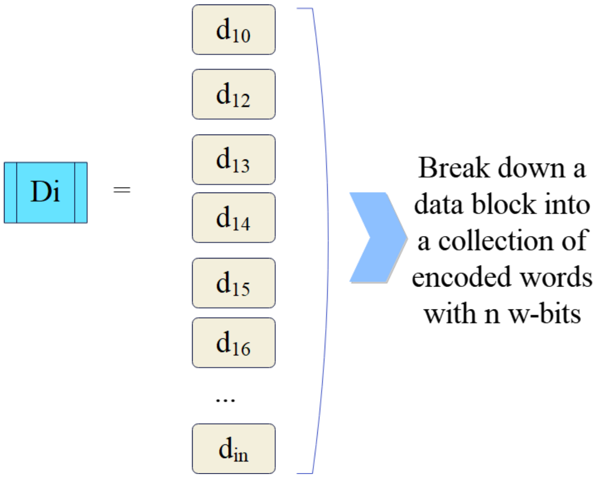

Figure 1: Schematic diagram of the splitting of data blocks.

The schematic diagram of data encoding and placement is shown in Figure 2. Among them, $c_{i,j} = F_i\left(d_{1,j}, d_{2,j}, \cdots, d_{m,j}\right), F_i$ is the verification function corresponding to each verification block.

The encoding process of the model is as follows:

If D is used to represent the original data, C is used to represent all the encoded data blocks in the encoded system, and the rows of the matrix F are used to represent the linear coefficients of F_i, then the system state can be expressed as C=FD. If F is defined as a matrix of $(n-m)\times m$, where n-m represents the number of parity data blocks in the system, and m represents the number of original data blocks in the system, then the system state can be expressed as:

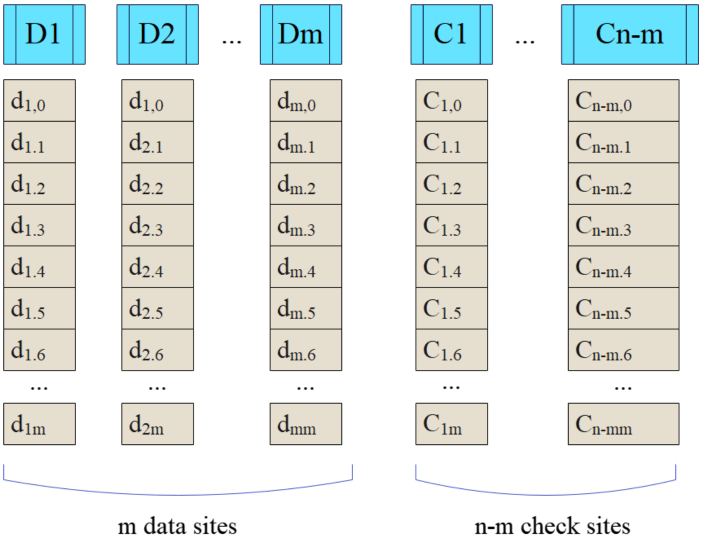

Figure 2: Schematic diagram of placement of information data and verification data.

$$\begin{bmatrix} c_1 \\ c_2 \\ \vdots \\ c_{n-m} \end{bmatrix} = \begin{bmatrix} f_{1,1}\, f_{1,2} \cdots f_{1,m} \\ f_{2,1}\, f_{2,2} \cdots f_{2,m} \\ \vdots\vdots\vdots\vdots \\ f_{n-m,1}\, f_{n-m,2} \cdots f_{n-m,m} \end{bmatrix} \begin{bmatrix} d_1 \\ d_2 \\ \vdots \\ d_m \end{bmatrix} \tag{2.1}$$

After such processing, the corresponding n check data blocks can be generated from the m original data blocks according to the coding matrix, and then these check data blocks can be stored in the storage system as redundant data together with the original data blocks. When no more than $n-m$ nodes in the system fail, the above equation can be combined to establish a corresponding linear equation system about the failure data, and the data in the failed node can be obtained by solving the equation system.

In order to ensure the high efficiency of the system, the coded data block consists of two parts: one part is the original data block, and the other part is the check data block. This design is to reduce the amount of calculation when the system does not fail, and only need to calculate $n-m$ checksum data blocks. In order to ensure that the original data block can be recovered if no more than one encoded data block is lost, the generation matrix of the check data must satisfy some other relations.

In order to illustrate this relationship, $A=\begin{bmatrix} I \\ F \end{bmatrix}, E=\begin{bmatrix} D \\ C \end{bmatrix}$ is defined separately. Among them, I is the identity matrix of $m \times m$, F and C are shown in the above equations, and D represents the corresponding m original data blocks. Then, the state of the entire system can be expressed by the following equation. From the perspective of this system state, after correspondingly deleting any row less than or equal to m in matrix A, the matrix is still full rank.

$$E=\begin{bmatrix} 1 & 0 & 0 & \dots & 0 \\ 0 & 1 & 0 & \dots & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & \dots & 1 \\ f_{1,1} & f_{1,2} & f_{1,3} & \dots & f_{1,m} \\ f_{2,1} & f_{2.2} & f_{2.3} & \dots & f_{2.m} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ f_{n-m,1} & f_{n-m,2} & f_{n-m,3} & \dots & f_{n-m,n} \end{bmatrix} \begin{bmatrix} d_1 \\ d_2 \\ d_3 \\ \vdots \\ d_m \end{bmatrix} = \begin{bmatrix} d_1 \\ d_2 \\ \vdots \\ d_m \\ c_1 \\ c_2 \\ \vdots \\ c_{n-m} \end{bmatrix} \tag{2.2}$$

The decoding process of the model is as follows:

When no more than n-m coded data blocks are invalid, the row corresponding to the invalid coded data blocks in the generator matrix can be simply deleted. The remaining sub-matrices form an invertible linear equation system of $m \times m$, and the information of all original data blocks can be recovered by solving this equation system by Gaussian elimination. Then, since the coding matrix is known, all the lost check data blocks can be recovered according to the recovered original data blocks. In this way, all data can be reconstructed.

Because some of the information data is not encoded, but stored in the disk in the form of original data blocks, the time complexity of decoding can be reduced according to the information.

For any one of the verification data blocks: $c_i = F_i\left(d_1, d_2, \cdots, d_n\right) = \sum_{j=1}^{n} d_j f_{i,j}$, if it is assumed that the data $d_{i_1}, d_{i_2}, \cdots, d_{i_k}$ on the k original data blocks is invalid, and the set $S=\left\{i_1, i_2, \cdots, i_k\right\}$ is recorded, the following operations can be performed on the verification data block c_i:

$$\begin{aligned} & c_i + d_h f_{i,h} + d_h f_{i,2} + \cdots + d_{ik} f_{i,k} \\ & = F_i\left(d_1, d_2, \cdots, d_n\right) + d_h f_{i,h} + d_i f_{i,i_2} + \cdots + d_{ik} f_{i,j_k} \\ & = \sum_{\text{j=1\$\$ jkS}}^{n} d_j f_{i,j} \end{aligned} \tag{2.3}$$

According to the above formula, a linear equation system with a relatively small coefficient matrix can be established. The number of unknowns in this linear equation system is equal to the number of invalid original data blocks. Therefore, the time complexity of the operation is greatly reduced when the Gaussian elimination method is used.

2.2 Efficiency Analysis

When the total number of encoded data blocks n is fixed, with the gradual increase of the number of original data blocks, the change of unit data encoding time is observed through simulation experiments. The total number of encoded data blocks n for the two simulation experiments is 10 and 20, respectively.

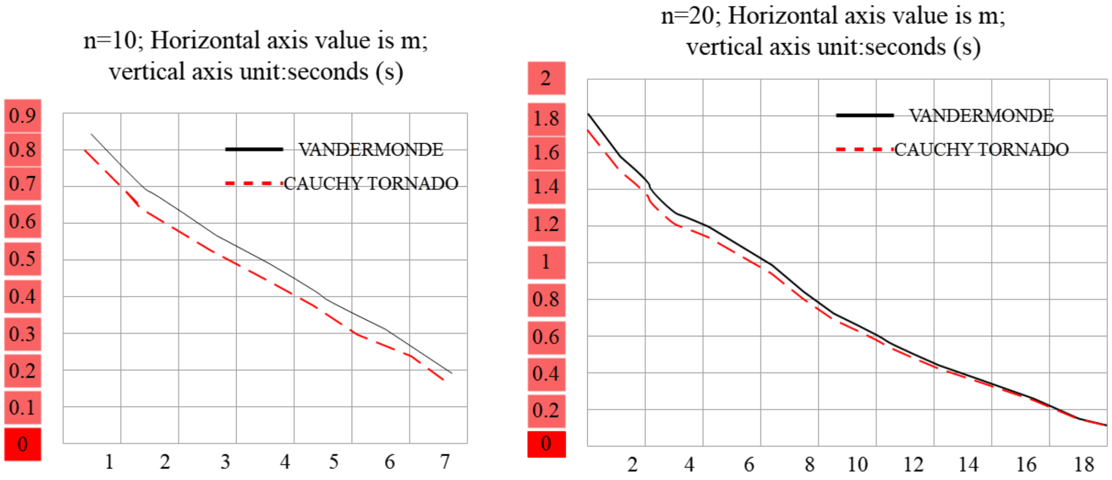

Figure 3: The effect of the number of data blocks on the encoding load when n=10 and n=20.

Figure 3 shows the effect of changing the number of data blocks on the encoding time when the encoded data is 1M and the value of n is 10 and 20, respectively. The longer the encoding time of unit data, the greater the encoding load of the system. It can be seen that as the value of m increases, the encoding time gradually decreases, so for the same data, as the number of data blocks increases, the load of encoding computation decreases.

If it is assumed that an original data D is composed of w code words, divided into m original data blocks, and the encoding matrix size is $n \times m$, the calculation of the encoded data is divided into two parts: The first part of the encoding calculation is the unit matrix $m \times m$, which can be simply regarded as assigning the original data block directly to the encoded data block; The second part is the calculation of the check data block, and the actual encoding matrix size is $(n-m) \times m$. The encoding operations of the original data D are $\frac{w}{m}$ groups, and each group undergoes $(n-m) \times m$ encoding operations, then the actual encoding operation time t of the data is proportional to the following results:

$$(n-m) \cdot m \cdot \frac{w}{m} = (n-m) \cdot w \tag{2.4}$$

It can be seen from this formula that when the value of n is fixed, that is, the scale of the system is fixed, the fewer the blocks, the longer the encoding time, and the greater the encoding load.

As the amount of encoded data gradually increases, the change of encoding time is observed through simulation experiments. The total number of encoded data blocks n in the two simulation experiments is 10 and 20 respectively, and the value of the number of data blocks m is half of the total number of encodings. Through this simulation experiment, two time data are obtained and observed, one is the total time required to encode the entire data, and the other is to calculate the encoding time of unit data in the matrix environment through the amount of data and the total encoding time.

The simulation results are as follows:

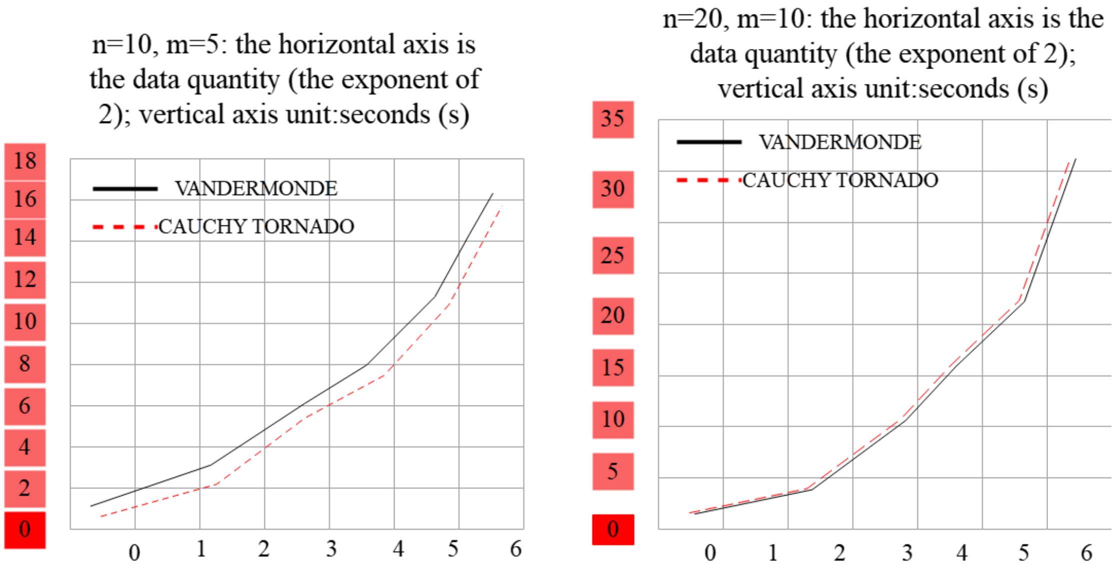

Figure 4: The total encoding time diagram when n=10, m=5 and n=20, m=10.

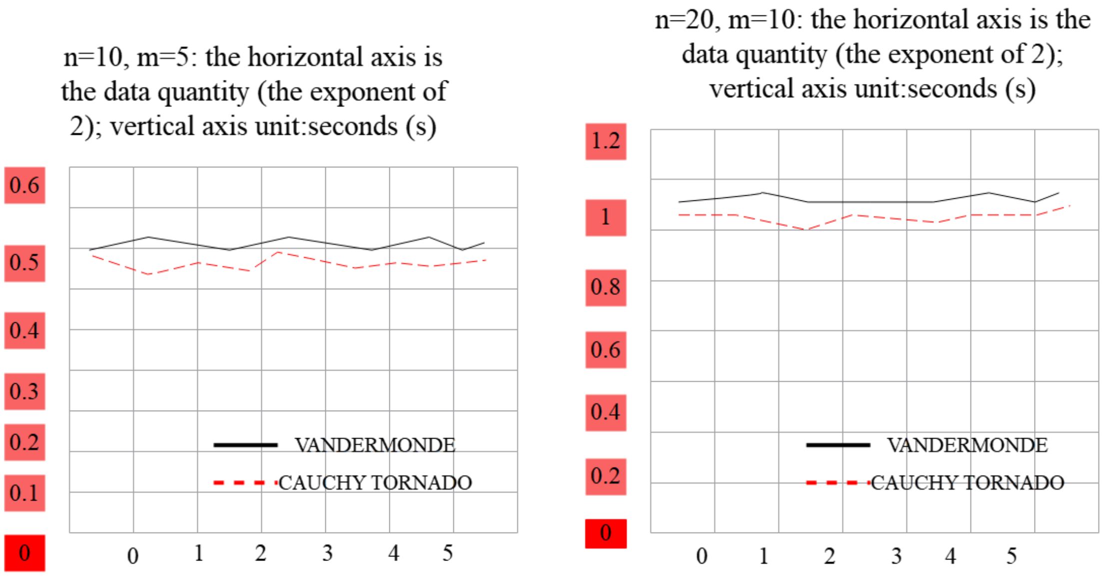

Figure 5: Coding efficiency when n=10, m=5 and n=20, m=10.

Figure 4 shows the total encoding time when the encoded data is gradually increased and n=10, m=5 and n=20, m=10. The amount of encoded data gradually increases according to the index of 2, and the unit is M. It can be seen that when the encoding matrix is fixed, the encoding time increases as the amount of encoded data increases. At the same time, since the coding methods based on the VANDERMONDE matrix and the CAUCHY matrix are similar, the total time required for coding the same data is not much different. However, the encoding of the TORNADO code is based on the exclusive OR operation, and the encoding time of the same data is less than the previous two encoding algorithms.

Figure 5 shows the coding efficiency when the coded data is gradually increased and n=10, m=5 and n=20, m=10. The amount of encoded data gradually increases with an index of 2, and the unit is M. It can be seen that when the encoding matrix is fixed, the encoding time of unit data does not increase with the increase of the total amount of encoded data, but gradually tends to be stable.

It can be seen from the above two experimental results that the RS code algorithms based on VANDERMONDE matrix and CAUCHY matrix use different special matrices. However, since the coding principle is the same, there is not much difference in coding efficiency. The TORNADO encoding uses the XOR operation, so the encoding efficiency is relatively good.

n=10, n=20 are respectively set, the m value is gradually increased, 1M data is encoded according to the n and m values, and the encoded data block is generated. Then, a part of the specified encoded data blocks (including the original data blocks and the check data blocks) are used to solve the original data through a decoding algorithm. The change rule of unit data decoding time under two matrix scales is observed respectively, and the influence of decoding algorithm on data decoding efficiency is analyzed.

The simulation results are as follows:

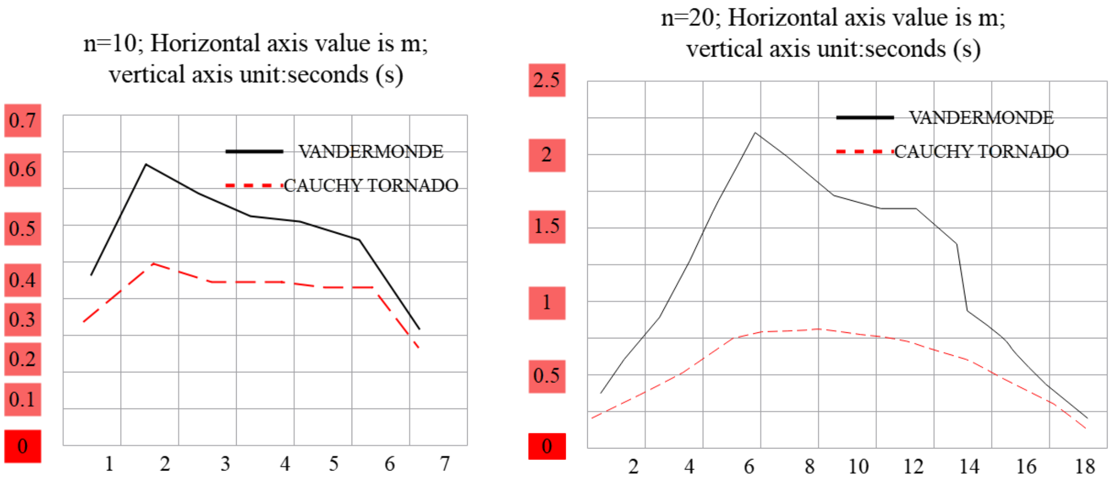

Figure 6: The effect of data block on decoding when n=10 and n=20.

Figure 6 shows the influence of the gradual increase of m value on the data decoding time when the data amount is 1M and n=10, n=20. It can be seen that the peak value of the decoding time of the RS code algorithm based on the VANDERMONDE matrix and the CAUCHY matrix is not when the number of the original data block and the check data block are equal. This phenomenon is analyzed as follows:

We assume that the unit data consists of w code words, the encoding matrix is $n \times m$, and the size of the decoding matrix is related to the number of parity data blocks in the decoding block used for decoding, which is assumed to be $m'\left(m' \leq m\right)$. If the size of the decoding matrix is $m' \times m'$, the number of times that a decoding algorithm needs to be executed is $m' \cdot m'$, and the decoding algorithm needs to be executed $\frac{w}{m}$ times for w code words to solve the original data. Then, $m' \cdot m' \cdot \frac{w}{m}$ number of operations are required to decode the original data using the encoded data block.

When the value of n of the system scale is constant, the value of m increases gradually, the number of check blocks in the system decreases gradually, while the number of encoded data blocks required for decoding increases gradually. When the number of parity data blocks is greater than the number of original blocks, it may happen that the encoded data blocks obtained during decoding are all parity data blocks. The decoding time required at this time is the longest. When the number of original data blocks is greater than the number of check data blocks, the decoded data can definitely get the original data blocks, so the decoding time will gradually decrease.

Therefore, a simulation experiment of randomly extracting coded data blocks and decoding can be designed to observe the relationship between the number of original data blocks and check data blocks and the decoding time.

n=10, n=20 are respectively set, the m value is gradually increased, 1M data is encoded according to the n and m values, and the encoded data block is generated. Then, a part of the encoded data blocks (including the original data block and the check data block respectively) are randomly selected by means of writing a random function, and the original data is solved by a decoding algorithm. The change rule of unit data decoding time under two matrix scales is observed respectively, and the influence of decoding algorithm on data decoding efficiency is analyzed.

The simulation results are as follows:

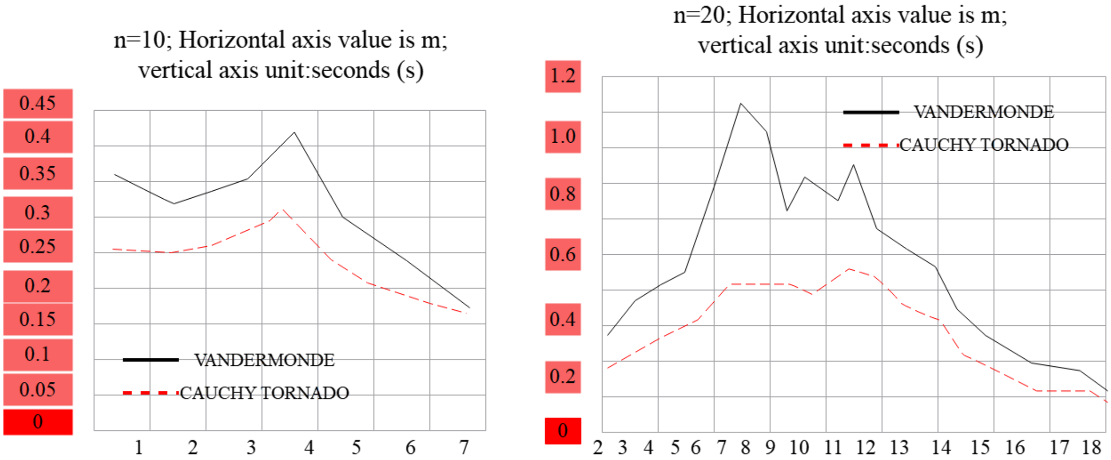

Figure 7: The effect of random selection of data blocks on decoding when n=10 and n=20.

Figure 7 shows the influence of the gradual increase of the m value on the decoding time of randomly selected encoded data blocks when the data amount is 1M and n=10, n=20. It can be seen that the peak value of the decoding time of the RS code algorithm based on the VANDERMNDE matrix and the CAUCHY matrix is not when the number of original data blocks and check data blocks are equal. This phenomenon is analyzed as follows:

We assume that the unit data consists of w encoded words, the encoding matrix is $n \times m$, the size of the decoding matrix is related to the number of parity data blocks in the decoding block used for decoding, and it is assumed to be $m'\left(m' \leq m\right)$. According to the probability, when the system scale is n and the number of check data blocks is $n-m$, the number of check data blocks in the randomly selected m encoded data blocks is $m' = \frac{n-m}{n} \cdot m$, and the size of the decoding matrix is $\left(\left(\frac{n-m}{n}\right)\cdot m\right)\times\left(\left(\frac{n-m}{n}\right)\cdot m\right)$. Then, a decoding algorithm needs to be executed for $\left(\frac{n-m}{n}\right)^2\cdot m^2$ times, and w code words need to be executed $\frac{w}{m}$ times to solve the original data. Then, the amount of computation required to solve the original data using the encoded data block is:

$$\left(\left(\frac{n-m}{n}\right)\cdot m\right)^2\cdot\frac{w}{m}=\left(\frac{n-m}{n}\right)^2\cdot m\cdot w \tag{2.5}$$

In this formula, m is a variable and can be simplified to find the extreme point of $(n-m)^2\cdot m$. It can be obtained that when $m=\frac{1}{3}n$ is a maximum value point of the formula, m=n is a minimum value point of the formula. This rule can be seen approximately from the experimental results.

The above two experiments can be seen, because the RS code based on the CAUCHY matrix uses the spherical inverse matrix in decoding, the time complexity is low, so the decoding efficiency is due to the RS code based on the VANDERMONDE matrix. Because the TORNADO code adopts the XOR operation method, the calculation amount is greatly reduced, so the decoding efficiency is lower than that of the VANDERMONDE matrix and the RS code based on the CAUCHY matrix.

If it is assumed that a data D consists of w coding units and is divided into m original data blocks, the number of check data blocks is m', and the size of the coding matrix is $(m+m')\times m$. Then it is divided into two parts during decoding. One part is the obtained encoded data block, that is, the original data block, so it is directly assigned. The second part is that the obtained encoded data block is a check data block, so decoding calculation is required. The decoding of data D requires $\frac{w}{m}$ operations, and according to the probability, the number of check data blocks contained in the acquired m encoded data blocks is $\frac{m'}{m+m'}\cdot m$. Therefore, the decoding of the data D requires $\frac{w}{m}\cdot\left(\frac{m\cdot m'}{m+m'}\right)^2=w\cdot\frac{m\cdot(m')^2}{(m+m')^2}$ operations.

When the value of m does not change, that is, the number of data blocks does not change:

$$w\cdot\frac{m\cdot(m)^2}{(m+m')^2}=w\cdot\frac{m}{\left(1+\frac{m}{m'}\right)^2} \tag{2.6}$$

It can be seen that the number of operations increases with the increase of m', so when the coded data blocks are randomly selected for decoding and the number of data blocks remains unchanged, the decoding time increases with the increase of the number of check data blocks.

When the value of m' remains unchanged, that is, when the number of check data blocks remains unchanged:

$$\frac{w}{m}\cdot\left(\frac{m\cdot m'}{m+m'}\right)^2 = w\cdot\frac{m\cdot(m')^2}{(m+m')^2} \tag{2.7}$$

The formula is derived:

$$\begin{aligned}\left(w\cdot\frac{m\cdot(m')^2}{(m+m')^2}\right)' &= w\cdot(m')^2\cdot\frac{(m+m')^2-2m(m+m')}{(m+m')^4}\\ &= w\cdot(m')^2\cdot\frac{(m+m')(m-m')}{(m+m')^4}=0\end{aligned} \tag{2.8}$$

Then when $m=m'$, the formula has a maximum value, so when $m<m'$, the decoding efficiency increases with the increase of the number of data blocks, and when $m>m'$, the decoding efficiency decreases with the decrease of the number of data blocks.

For the decoding expansion efficiency $S_d=\frac{t_{d(n'\times m)}}{t_{d(n\times m)}}$, when the system scale is expanded from $n_1\times m_1$ to $n_2\times m_2$, two cases are discussed:

1. When the number of original data blocks is unchanged, that is, when $m_1=m_2$, we set $m_1'=n_1-m_1, m_2'=n_2-m_2\ and\ m_2'>m_1'$,

$$S_d=\frac{t_{d(n'\times m)}}{t_{d(n\times m)}}=\frac{w\cdot\frac{m_2\cdot(m_2)^2}{(m_2+m_2)^2}}{w\cdot\frac{m_1\cdot(m_1)^2}{(m_1+m_1')^2}}=\frac{(m_2)^2\cdot(m_1+m_1')^2}{(m_1)^2\cdot(m_2+m_2')^2} \tag{2.9}$$

because:

$$\begin{aligned}&(m_2)^2\cdot(m_1+m_1')^2-(m_1)^2\cdot(m_2+m_2')^2\\ &=(m_2)^2\cdot\left(m_1^2+2\cdot m_1\cdot m_1'+(m_1')^2\right)-(m_1)^2\cdot\left(m_2^2+2\cdot m_2\cdot m_2'+(m_2)^2\right),\\ &=m_1^2\left((m_2)^2-(m_1)^2\right)+2\cdot m_1\cdot m_1\cdot m_2'(m_2'-m_1)>0\end{aligned} \tag{2.10}$$

Therefore, when the number of data blocks remains unchanged, $S_d>1$.

2. When the number of checksum data blocks is unchanged, that is, when $m_1'=n_1-m_1, m_2'=n_2-m_2, m_1'=m_2'$ and $m_2>m_1$,

$$S_d = \frac{t_{d(n'\times m)}}{t_{d(n\times m)}} = \frac{w\cdot\frac{m_2\cdot(m_2)^2}{(m_2+m_2')^2}}{w\cdot\frac{m_1\cdot(m_1)^2}{(m_1+m_1)^2}} = \frac{m_2\cdot(m_1+m_1')^2}{m_1\cdot(m_2+m_2')^2} \tag{2.11}$$

because:

$$\begin{aligned} & m_2\cdot(m_1+m_1')^2 - m_1\cdot(m_2+m_2)^2 \\ & = m_2\cdot\left(m_1^2+2\cdot m_1\cdot m_1'+(m_1)^2\right) - m_1\cdot\left(m_2^2+2\cdot m_2\cdot m_2'+(m_2)^2\right) \\ & = m_2\cdot m_1^2 - m_1\cdot m_2^2 + m_2\cdot(m_1)^2 - m_1\cdot(m_2)^2 \\ & = \left(m_1\cdot m_2-(m_1)^2\right)\cdot(m_2-m_1) \end{aligned} \tag{2.12}$$

Therefore, when the number of checksum data blocks is unchanged, when $m_1\cdot m_2-(m_1)^2>0$, that is, $m_2>\frac{(m_1)^2}{m_1}$, $S_d>1$. When $m_1\cdot m_2-(m_1)^2<0$, namely $m_2<\frac{(m_1)^2}{m_1}$, $S_d<1$.

3 TPACK ABILITY AND TRAINING OF PRIMARY SCHOOL TEACHERS UNDER THE BACKGROUND OF MOBILE INTERNET

TPACK is a new knowledge formed after integrating three knowledge elements, which involve many conditions and factors, and interact with each other, as shown in Figure 8.

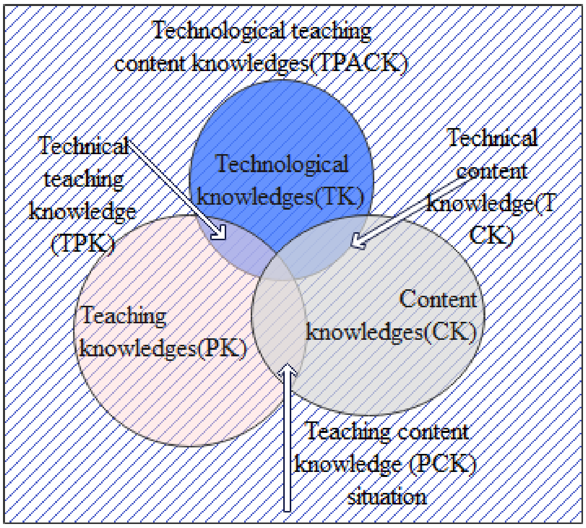

Figure 8: TPACK structure diagram.

For the training of teachers' informatization ability teaching content, teachers are required to understand that the design of teaching content needs to rely on multi-dimensional comprehensive knowledge. The TPACK framework elaborates the subject content, teaching technology and teaching methods required for teachers' informatization teaching design. Teachers should combine informatization skills with teaching practice topics, and organize teaching according to the problem-based spiral mode. It is necessary to analyze the basic situation of students, design resources, and design teaching, and then develop the courseware, implement the compilation of teaching plans, and optimize and reflect on the design results. Figure 9 shows the system architecture of the primary school teachers' informatization teaching ability training model system based on TPACK.

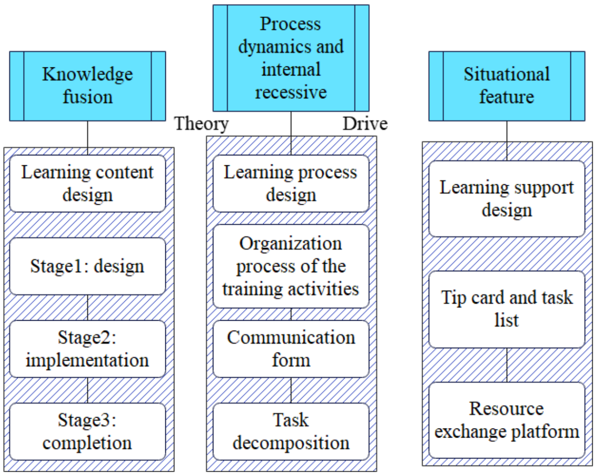

Figure 9: System architecture of primary school teachers' information-based teaching ability training model based on TPACK.

Combined with the intelligent TPACK data processing algorithm proposed in the second part, this paper carries out the effect of the TPACK-based primary school teachers' informatization teaching ability training model, conducts simulation evaluation through multiple sets of data, and obtains the evaluation results shown in Figure 10.

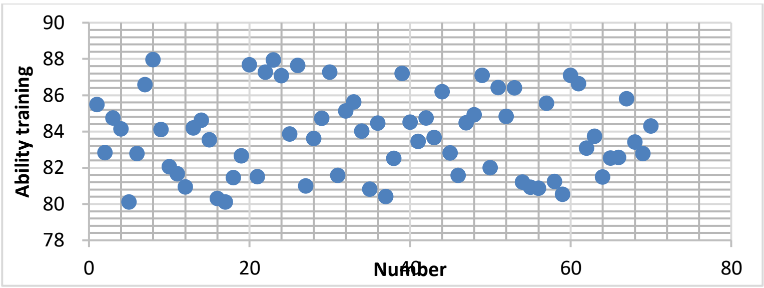

Figure 10: Evaluation of the effect of the training model of primary school teachers' informatization teaching ability based on TPACK.

Based on the above research, it can be seen that the training model of primary school teachers' informatization teaching ability based on TPACK proposed in this paper can help primary school teachers to improve their informatization teaching ability.

5 CONCLUSION

With the advent of the Internet era, information technology has developed rapidly. Under such a background, junior high school teachers want to improve their teaching quality, they need to work hard to learn the relevant knowledge of informatization, and for the first time to enhance their own informatization teaching ability level. The background of the new era has also brought unprecedented challenges to teachers. When teachers use information technology to teach students, they must pay attention to cultivating students' comprehensive quality. At the same time, it is necessary to make the curriculum more hierarchical and differentiated, so that students can always be attracted by the course content, thereby improving the quality of teaching. The application of TPACK framework also further demonstrates the importance of information technology to improve the quality of classroom teaching. It can be seen that if teachers want to keep up with the times and further improve the quality of students' learning, they need to not only innovate their own ideas, but also promote the teaching process to adapt to the needs of the times. This paper studies the TPACK ability training of primary school teachers combined with mobile Internet technology, and explores a reliable method to improve the TPACK ability of primary school teachers. Through the experimental research, it can be seen that the training model of primary school teachers' informatization teaching ability based on TPACK proposed in this paper can help primary school teachers to improve their informatization teaching ability.

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