Optimisation of Driver’s Traffic Literacy Evaluation Index from the Perspective of Information Contribution Sensitivity

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1. Introduction

With the rapid development of urbanisation, the total demand for transportation and motor vehicles has continued to increase. However, road congestion is also becoming more serious, traffic accidents occur frequently, and violations of traffic regulations are continually occurring. According to estimates by the World Health Organization (WHO), about 1.35 million people die from road traffic injuries, which means that 3,700 people die from road traffic accidents every day (2018) [1]. Other studies have proved that human factors cause more than 90% of traffic accidents [2, 3]. The practice has proven that relying solely on large-scale transportation facilities cannot fundamentally alleviate urban transportation problems. As the main participants of transportation, motor vehicle drivers should improve their transportation literacy and jointly cope with transportation problems. To this end, this article attempts to establish and optimise a model for evaluating urban driver traffic literacy to create a theoretical foundation to evaluate the traffic literacy of urban drivers.

Research on traffic literacy evaluation indexes at home and abroad is scarce, and most literature has focused on researching the factors that affect traffic accidents [4–6]. Most traffic accidents occur because traffic participants have a relatively poor understanding of safe traffic, and many scholars have evaluated their status by constructing safe traffic evaluation index systems. For example, Zhang et al. [7] took the status of local transportation system safety management as the evaluation object and divided the indexes that reflect safe traffic conditions into three categories, veto indexes, qualitative indexes, and quantitative indexes, to build safe traffic evaluation index systems. Guo et al. [8] constructed a rail transit safety evaluation index system model composed of 14 evaluation indexes from three aspects: the train’s safety, the interface between the train and other systems, and the safety guarantee system. Scholars have carried out systematic research on the evaluation index...
systems of green transportation [9, 10], intelligent transportation [11], and harmonious transportation [12]. Many studies have also been conducted on the impact of traffic safety, such as drivers’ attitudes and behaviours towards traffic safety [13], the use of safety devices during driving [14], and drivers’ traffic violations [15].

However, none of those abovementioned studies has been researched from the perspective of drivers’ traffic literacy. Traffic literacy can better reflect a person’s necessary driving qualities and gradually reduce the probability of traffic safety incidents under the joint influence of knowledge acquisition, skill mastery, safety awareness, and driving safety behaviour. At present, the concept of transportation literacy is still in the exploratory stage. Based on the existing literature analysis, this paper sorts out the factors that affect the driver’s traffic literacy and uses an improved mathematical method to screen the indexes, hoping to lay a theoretical foundation for the further evaluation and improvement of the driver’s traffic literacy.

Studying whether the evaluation index system of traffic literacy is reasonable will directly affect the evaluation results’ scientificity. At present, research on the optimisation methods of evaluation indexes is relatively extensive. The principal component analysis method is often used to select the original indexes. For example, Tung and Lee [16] used principal component analysis to reduce the dimensionality of many enterprises’ financial indexes based on the grey theory method. Zheng et al. [17] used the principal component analysis method to optimise the comprehensive evaluation index system of reservoirs after an earthquake, reduced 15 risk factors to two principal components, and eliminated redundant information indexes. A variety of other methods are also used to screen and optimise the original indexes. Liu et al. [18] conducted nonparametric Bayesian discrimination for the first round of screening for all credit indexes and nonparametric clustering for the second round of screening for retained credit indexes and provided a set of nonparametric methods for screening credit evaluation indexes with unknown index distributions. Xu et al. [19] used a combination of correlation analysis, frequency analysis, principal component analysis, grey correlation analysis, membership function analysis, cluster analysis, and stepwise regression analysis to complete the selection of drought resistance indexes. Zhu et al. [20] used the Memetic Algorithm to optimise the index parameters extracted by the 3D wavelet transform to obtain distinct and parsimonious feature sets and perform accurate classification. The main problems in the existing research are as follows. First, the indexes are screened and optimised using various research methods, the dimensions of the indexes cannot be reduced, and the original indexes have not changed. Second, the selected method can only optimise the index, but it cannot determine the index’s weight after optimisation.

This paper establishes an index selection and weighting method based on the sensitivity of information contribution, which retains the significant and low information overlap indexes and weights the indexes according to the sensitivity of information contribution. First, through the definition of the concept of traffic literacy and by combining the factors that affect traffic literacy, the formation mechanism, the purpose of evaluation, etc., a traffic literacy evaluation index system was proposed, and a questionnaire was designed based on the initially established evaluation index system to obtain the original data. Second, the concept of the sensitivity of index information contribution, which is the sum of the difference between the main component and the cumulative contribution rate of the corresponding principal component variance, is proposed. Indexes with less sensitive information contribution are excluded; the retained indexes can reflect most of the original indexes’ information. Finally, all indexes are weighted according to the proportion of each index’s information contribution sensitivity to the sum of all indexes’ information contribution sensitivities. The weight of the indexes reflects the relative information content of different indexes.

2. Theory

2.1. Definition of the Concept of Driver Traffic Literacy. By analysing the literature and drawing on previous research experience, we believe that the concept of literacy can be introduced to the study of driver traffic behaviour, and the current traffic problem can be regarded as a “human action.” Therefore, the prerequisite for solving such problems is to improve the traffic action literacy of drivers, that is, their “traffic literacy.” We draw lessons from the definition of literacy by Ritchhart [21] of Harvard University: an acquired behaviour pattern that includes multiple behaviours and is subjectively active. In the development process of a specific situation, these behaviours are dynamic and exceptional and must be combined with necessary abilities. Another definition of thinking literacy is that it is not merely a subjective desire or tendency to think critically in a specific situation. Simultaneously, it is necessary to form habits to use skills or actively believe and choose to use their abilities [22].

Traffic literacy is a kind of professional literacy with practical significance. It refers to the traffic behaviours or tendencies that traffic participants gradually develop in long-term driving activities and the awareness, attitude, and control ability to drive activities. It mainly refers to a comprehensive quality that people gradually accumulate due to coping with various road traffic conditions, the awareness of traffic, the relationship between people and the traffic environment, and the treatment of traffic conditions by individuals. It is the sum of specific transportation knowledge and experience, reasonable method skills, and people-oriented green awareness. The formation of traffic literacy begins with the grasp of traffic knowledge by individuals and develops through the cultivation and formation of a healthy traffic awareness; eventually, the traffic knowledge is mastered, and a sound awareness of traffic safety is established and converted into a skill that is used to guide actions.

2.2. Basic Components of Driver Traffic Literacy. This part draws on previous studies on driver prevention of traffic accidents, combined with the author’s research experience,
and explores the factors that affect drivers' traffic literacy levels from four dimensions: knowledge, awareness, skills, and behaviour.

2.2.1. Driver’s Traffic Knowledge. Some studies believe that changes in knowledge will reduce traffic safety accidents [23, 24]. Driver’s traffic knowledge means that traffic participants need to master the corresponding rules, such as traffic rules, mechanical common sense, and knowledge of laws and regulations. The first task of traffic literacy is to make the road participants understand their environment to determine the appropriate driving means accurately. According to an analysis of statistical data from a United Nations survey in 2016, the fatality rate of traffic accidents in developed countries was less than 4%, and the death toll was 1.2–1.7 people per 10,000 vehicles, while the fatality rate in China was as high as 22%, and the death toll was approximately 3.3 people per 10,000 vehicles. Both of China’s evaluation indexes are higher than those of developed countries. Most of the causes of accidents are the driver’s insufficient traffic experience and noncompliance with traffic laws [25, 26]. In today’s rapidly developing traffic environment, mastering sufficient traffic knowledge and experience will lay the foundation for driving in traffic. For example, only by understanding the road signs’ information can the driver know the road conditions they are driving on. Studies have proved that a better understanding of traffic signs will promote good traffic behaviour [27] so that it will not be easy to conflict with other traffic participants and avoid unnecessary disputes.

2.2.2. Driver’s Traffic Awareness. Driver traffic awareness is an inherent extension of traffic literacy, reflecting the driver’s moral cultivation and reflecting how people treat others and deal with the traffic environment. A cautious driving attitude should be formed, and a correct road traffic concept should be established, mainly in terms of safety awareness, kindness to others, values, and situation foresight. Changing people’s attitudes towards traffic laws is crucial in preventing traffic accidents [28]. When drivers have strong traffic risk perception capabilities, they will take the initiative to take certain protective traffic behaviours [29]. For traffic drivers, safety and equality need to be considered in establishing traffic awareness [30, 31], and the main emphasis is on traffic safety awareness. Values are also the main representation of the level of traffic awareness. They give the driver a subjective judgment, drive behaviour standards, and shape their driving behaviour [32–34]. In recent years, personal moral issues related to transportation have gradually attracted people’s attention [35–37]. The concept of traffic ethics will affect traffic participants’ consciousness to comply with laws and regulations and determine whether they can correctly view the position of traffic participants in the transportation society and their relationships with other participants. Correct traffic concepts and attitudes should lead to the establishment of the concepts of “safety first” and “treat others” and the further formation of an attitude of “driving cautiously,” “obeying orders,” and “being polite to others.”

2.2.3. Driver’s Traffic Skills. Driving is a complex task that relies on different skills [38]. The perception of traffic skills can affect self-regulation behaviours during driving and prevent unnecessary driving behaviours [39]. Traffic skills are a further manifestation of traffic awareness and a specific means to reflect traffic knowledge. It is divided into two dimensions: perception of motor skills and safety skills [40]. The driver’s traffic skills can transform the knowledge he already knows into skills, be proficient in manipulating the vehicle, and take timely action in response to sudden road conditions. Skills are the prominent ability to make correct judgments and operations based on knowledge and experience. If the driver overestimates his driving skill level, potential hazards will occur [41]. By investigating the status of people involved in traffic accidents, it was found that participants with relatively low skills accounted for a relatively high proportion of the accident group [42]. Only transforming traffic knowledge into a driving ability and gradually forming traffic skills that can be directly used in manipulating vehicles and then positively intervening in driving behaviour will reduce driving safety incidents. Some studies have also proved that skills are closely related to behaviour and accidents [43, 44].

2.2.4. Driver’s Traffic Behaviour. Traffic knowledge, traffic awareness, and traffic skills are all directly established at the traffic participants’ level, which indirectly affects drivers’ traffic literacy level. Driver traffic behaviour is aimed at the driver’s actual action level, which is the most direct reflection of driver traffic literacy. Studies have shown that traffic accidents’ leading cause is the driver’s improper behaviour (76.1%) [45]. The driver’s traffic behaviour is a process of continuously receiving, analysing, and responding to the surrounding environment and changes. The external environment’s quality may increase the probability of violations [46]. For example, when drivers believe that the external environment is normal, they will often show more dangerous driving behaviours [47].

On the contrary, the driver cannot be affected by the external environment, make certain self-management behaviours, and safely control the vehicle, effectively reducing the possibility of traffic accidents. As a kind of cognitive behaviour, safe and civilised behaviour can reduce driving aggression caused by angry and risky driving behaviours [48, 49]. Therefore, focusing on cultivating drivers’ safe and civilised behaviour will directly affect every link of the driving process and reduce traffic accidents.

2.3. Construction of the Driver Traffic Literacy Index System. The construction of a driver traffic literacy evaluation system is a multi-index and multilevel comprehensive evaluation problem, which contains more content, involves a broader range, and is more complicated. There are many problems related to transportation literacy, and the corresponding influencing factors can be divided into dozens or hundreds of factors. For the convenience of research and the operability of the evaluation model, combined with the influencing factors, formation mechanism, evaluation purpose,
and index selection principles of traffic literacy, the traffic literacy evaluation index system is constructed according to the four dimensions of knowledge, awareness, skills, and behaviour. There are 13 indexes in the specific subjective index layer, including traffic rules, common sense of machinery, knowledge of laws and regulations, safety awareness, kindness to others, values, situation foresight, vehicle control, precautionary measures, emergency measures, self-management behaviour, driving control behaviour, and safe and civilised behaviour, as shown in Table 1.

3. Material and Empirical Analysis

3.1. Data Sources and Analysis. Based on the Likert five-level scale, this study designed a questionnaire to assess “evaluation of traffic literacy of motor vehicle drivers” with a total of 17 questions. To ensure the data integrity of individual indexes, we consulted experts in related fields on the design ratio of questionnaire questions. Finally, it is determined that the four indexes of traffic rules, safety awareness, vehicle control, and self-management behaviour each correspond to 2 questions, and the other indexes correspond to 1 question. The survey respondents selected persons with driving experience within the administrative area of Zhengzhou City and issued a total of 550 questionnaires to eliminate complete questionnaires (for example, the online questionnaire has a short response time, and more than 80% of the questions are answered for the same option; the questionnaire is not completed completely). Finally, 393 valid questionnaires were obtained, and the sample efficiency was 71.45%. The preliminary analysis of the questionnaire data shows that the Cronbach’s α coefficient of the questionnaire is 0.821, which indicates that the overall questionnaire has good reliability. Through the KMO test on the questionnaire data, the questionnaire’s KMO value was 0.854, and the significance p value of the Bartlett sphere test is less than 0.05. The cumulative variance contribution rate of the common factor was 63.311%. Each entry’s load value on a common factor was greater than 0.4, and the load values of other common factors were below 0.4, indicating that the questionnaire for traffic literacy of motor vehicle drivers has a higher validity.

3.2. Empirical Analysis Results

3.2.1. Screening of Indexes Based on Information Contribution Sensitivity. According to the data collected from the questionnaire survey, the data of each index are first standardized to obtain a standardized matrix Z, and the standardized matrix is solved for the correlation coefficient matrix R:

\[
R = [r_{ij}]_{13 \times 13} = X^T X
\]

as shown in Table 2.

The correlation coefficient matrix R is brought into the formula \(|R - \lambda_i E_n| = 0\), where \(E_n\) is a n-order identity matrix, and the eigenvalue \(\lambda_i\) is obtained. The obtained eigenvalue \(\lambda_i\) is brought into the formula \(\omega_i = \lambda_i/\sum_{i=1}^{n} \lambda_i\), and the variance contribution ratio of principal component \(Z_i\) to \(\omega_i\) is calculated \((Z_i, j = 1, 2, \ldots, k\), and \(k\) is the number of retained principal components). \(\omega_i\) is the proportion of the i-th principal component \(Z_i\) explaining the total variation of all 13 original indexes and reflecting the proportion of the information content of the i-th principal component \(Z_i\) that occupies the information content of all indexes. The larger this value is, the more the original information of the main component \(Z_i\) is carried by \(X_1, X_2, \ldots, X_{13}\).

Based on the variance contribution rate of each principal component, the proportion of the sum of the information content of each principal component in the former \(k\) to the information content of all original indexes is calculated, that is, the cumulative variance contribution rate \(U_k = \sum_{i=1}^{k} \omega_i\). The cumulative variance contribution ratios of the first \(k\) principal components are arranged from the largest to the smallest. In general, when the eigenvalues of the indexes are greater than 1 and the cumulative variance contribution rate exceeds 60%, these principal components contain the main information of most measurement indexes [50]. In this study, if the first three principal components’ cumulative variance contribution rate is retained, the first three principal components with the largest variance contribution ratio are retained. The calculation results are shown in Table 3.

The eigenvector \(p_i^T\) that is orthogonally unitized by the correlation coefficient matrix R is obtained from the basic solution system of the following linear equations with the formula \((R - \lambda_i E_n)x = 0\). The initial matrix and eigenvalues formed by all the data are brought into the formula to obtain the eigenvectors of the three principal components. The calculation results of the orthogonalization of the eigenvectors to the absolute value are shown in Table 4.

The main information of the original index is expressed by a few principal components \(Z_i\), and its expression formula is as follows:

\[
Z_i = p_{i1}X_1 + p_{i2}X_2 + \cdots p_{ij}X_j + \cdots p_{in}X_n
\]

(2)

Based on this result, the sensitivity \(\alpha_{ij}\) of the i-th principal component affected by the size change of the j-th index is calculated as follows:

\[
\alpha_{ij} = \frac{|Z_i^* - Z_i|}{|X_j^* - X_j|} = |p_{ij}|
\]

(3)

In this paper, the result of the difference operation is approximated to the orthogonalization of the eigenvectors to determine the absolute value. The calculated data are shown in Table 4.

The sensitivity \(\beta_{ij}\) of the information of all original indexes through the i-th principal component, which is affected by the change of the size of the j-th index and the information contribution sensitivity \(\beta_j\) of the fourth index, is calculated.
Information of all the original indexes. Based on this, to ensure the maximum information contribution and prevent the omission of information from individual indexes, the first \( m \) indexes that meet the value of the cumulative information contribution rate \( \gamma_m \) at a level of 90% or greater are selected and retained. The specific calculation data are shown in Table 5. The cumulative information contribution sensitivity of the 10th line is 90.00%. Therefore, the first 9 indexes are retained, and the 3 indexes with lower contribution rates such as \( X_6, X_3, \) and \( X_{12} \) are excluded.

### 3.2.2. Index Weighting Based on Information Contribution Sensitivity

The core idea of index weighting is to divide the sensitivity of each index’s information contribution by the sum of the sensitivity of the information contribution of all indexes. The formula is

\[
\omega_r = \frac{\beta_r}{\sum_{j=1}^{n} \beta_j}, \quad (r = 1, 2, \ldots, n).
\]  

This article presents the weighting results based on index selection, as shown in Table 5. It should be noted that after the index selection is completed, the problems corresponding to the elimination index shall be deleted, and the reserved indexes shall be reempowered. The specific process is not shown in detail.
4. Discussion

The influencing factors of driver’s traffic literacy are discussed from four dimensions through the analysis of the existing literature. Literacy is a collection of preferences, attitudes, intentions, and the related ability to reflect preferences in a specific way \[51\]. Therefore, we believe that the driver’s literacy should include knowledge, awareness, skills, and behaviour. These four dimensions comprehensively reflect the driver’s overall quality in the entire driving process from basic theory to behaviour implementation. Based on these four dimensions, the representative indexes in each size (such as traffic knowledge including traffic rules, laws, and regulations) are further screened out. The driver’s traffic literacy level can be evaluated more scientifically and comprehensively. Government departments or organizations can also take some targeted measures based on these indexes to guide drivers to improve their traffic literacy continuously. Implementing some positive measures will help reduce the occurrence of traffic accidents, make urban traffic more orderly, and meet the needs of social and economic development and people’s lives.

The rationality of indexes directly affects the results of the evaluation. In many studies, relying on indexes’ relative importance can only reflect the importance of the amount of information reflected by an index relative to the evaluation results \[52–55\]. However, in the era of big data, the dimensions of index sets presented by different evaluation systems are becoming more and more complex, and there will inevitably be information overlap between indexes. Screening indexes based on relative importance cannot determine the collinearity between indexes and whether there is an overlap of information. Some scholars have adopted principal component dimensionality reduction methods to reduce information overlap \[56, 57\], but only using the size of the load factor cannot effectively reflect the information content of the index and cannot determine the weight of the index. From the perspective of information contribution sensitivity, this study uses improved principal component analysis methods to prioritize the retention of indexes with greater information contribution sensitivity. The research results ensure that the retained evaluation indexes carry more information from the original data set and achieve a low degree of information overlap between the indexes, guaranteeing the rationality of the evaluation system and at the same time getting the weight of each index.

The research results obtained by using this research method show that the knowledge of laws and regulations in the traffic knowledge, the kindness to others in the traffic awareness, and the driving control behaviour in the traffic behaviour are deleted. These three indexes carry a small amount of information (information contribution rates are 4.32%, 3.1%, and 2.23%) and overlap with the amount of information carried by other indexes. For example, the “traffic rules” in traffic knowledge will include part of the knowledge of traffic laws and regulations, which will lead to overlap of information; another example is that there is an inevitable overlap of information between the indexes “be kind to others” and “values.” Kaçan et al. \[34\] believe that traffic values are obtained through dominant social background and unique personal experience. The direction and emotional intensity of behaviour can be given, and standards can be specified to judge and prove the rationality of actions. A driver with good traffic values will reasonably control the

| Table 2: Correlation coefficient matrix of the original index. |
|---|---|---|---|---|---|---|
| Index | $X_1$ | $X_2$ | $X_3$ | $X_4$ | $X_5$ | ... | $X_{13}$ |
| $X_1$ | 1.0000 | 0.457 | 0.612 | 0.526 | 0.320 | ... | 0.222 |
| $X_2$ | 0.457 | 1.000 | 0.589 | 0.527 | 0.275 | ... | 0.127 |
| $X_3$ | 0.612 | 0.589 | 1.000 | 0.628 | 0.387 | ... | 0.237 |
| $X_4$ | 0.526 | 0.447 | 0.527 | 1.000 | 0.628 | ... | 0.234 |
| $X_5$ | 0.320 | 0.275 | 0.387 | 0.628 | 1.000 | ... | 0.218 |
| ... | ... | ... | ... | ... | ... | ... | ... |
| $X_{13}$ | 0.222 | 0.127 | 0.237 | 0.234 | 0.218 | ... | 1.000 |

| Table 3: Characteristic values and contribution rates of principal components. |
|---|---|---|
| Number/item | Eigenvalues | Variance contribution rate | Cumulative variance contribution rate |
| | $\lambda_i$ | $\omega_i$ (%) | $U_k$ (%) |
| 1 | 6.697 | 51.518 | 51.518 |
| 2 | 1.173 | 9.025 | 60.543 |
| 3 | 1.074 | 7.494 | 68.037 |
| 4 | 0.839 | 6.455 | 74.492 |
| 5 | 0.608 | 4.880 | 79.172 |
| 6 | 0.531 | 4.084 | 83.256 |
| 7 | 0.469 | 3.605 | 86.861 |
| 8 | 0.395 | 3.035 | 89.896 |
| 9 | 0.345 | 2.655 | 92.551 |
| 10 | 0.329 | 2.528 | 95.078 |
| 11 | 0.264 | 2.033 | 97.112 |
| 12 | 0.243 | 1.871 | 98.983 |
| 13 | 0.132 | 1.017 | 100.000 |
implementation of his own emotions and behaviours in the traffic interaction with others, take the initiative to treat others kindly, and effectively avoid traffic injuries. As a subjective behaviour of the driver, driving control behaviour occurs during the entire driving process. However, as the number of vehicles on the road gradually increases, the degree of automation is getting higher and higher [58], and different countries and regions have aligned their driving licenses. The standards for examinations have gradually increased, and the driver’s driving control knowledge and skills have been improved in driving training [59, 60], making the driver more instinctively focused on behaviour in the actual driving process. As a result, this index’s impact on traffic literacy is relatively low during the investigation process.

The research results show that the weights of the three mechanical knowledge indexes, safety awareness, and values are relatively high, all greater than 0.1. “Mechanical knowledge” can better reflect the driver’s understanding of the vehicle, master the driving tool’s performance and operation instructions, and enhance the interaction between the driver and the vehicle information [61], which guarantees the driver a prerequisite for safe driving. Safety awareness and values belong to traffic awareness. Studies have shown that changing people’s attitudes towards traffic is essential to prevent traffic accidents. When drivers have a solid ability to perceive traffic risks, they will take the initiative to take certain protective behaviours [28]. Schwartz [62] believes that values are universal, but their importance varies from person to person and is a dynamically changing emotional state. Values exist in the individual at different levels, thereby affecting the individual’s real-life behaviour [63]. When applied to the driving environment, they interact with their knowledge reserves and master skills, thereby affecting their driving behaviour. Driving behaviour as a direct factor that affects the driver’s traffic literacy does not show a greater weight, which may be related to the behaviour as an actor in the driver’s daily driving activities and has not attracted the driver’s attention.

### 5. Conclusions

Through an analysis and induction, a traffic literacy evaluation index system was constructed based on the concept of traffic literacy. This system includes thirteen indexes, such as safety awareness, traffic rules, vehicle control, emergency

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**Table 4: The results of orthogonal normalization of the first three principal component eigenvectors to determine the absolute values.**

| Serial number | Index | Eigenvector orthogonal normalization to determine the absolute value | Information contribution sensitivity |
|---------------|-------|------------------------------------------------------------------|-------------------------------------|
|               |       | $|P_1|$, $|P_2|$, $|P_3|$                                           | $\beta_j$                          |
| 1             | $X_1$ | 0.2280, 0.5124, 0.0231                                         | 0.1654                             |
| 2             | $X_2$ | 0.3917, 0.1167, 0.0328                                         | 0.2148                             |
| 3             | $X_3$ | 0.0996, 0.0876, 0.0342                                         | 0.0618                             |
| 4             | $X_4$ | 0.3678, 0.2321, 0.0239                                         | 0.2122                             |
| 5             | $X_5$ | 0.6317, 0.4582, 0.0625                                         | 0.3715                             |
| 6             | $X_6$ | 0.1565, 0.0287, 0.0375                                         | 0.0860                             |
| 7             | $X_7$ | 0.2302, 0.5372, 0.0096                                         | 0.1678                             |
| 8             | $X_8$ | 0.1289, 0.2220, 0.1862                                         | 0.1004                             |
| 9             | $X_9$ | 0.1537, 0.1769, 0.6955                                         | 0.1473                             |
| 10            | $X_{10}$ | 0.1748, 0.2200, 0.6737 | 0.1604                             |
| 11            | $X_{11}$ | 0.1772, 0.1047, 0.1287 | 0.1104                             |
| 12            | $X_{12}$ | 0.0896, 0.0066, 0.0484 | 0.0504                             |
| 13            | $X_{13}$ | 0.2502, 0.1513, 0.0033 | 0.1428                             |

**Table 5: Index screening and weighting based on cumulative information contribution sensitivity.**

| Serial number | Index (1) | Metrics are sorted by the value of $\beta_j$ | Cumulative information contribution sensitivity $y_{\mu}$ | Retained and removed indexes | Weights |
|---------------|-----------|----------------------------------------------|----------------------------------------------------------|------------------------------|---------|
| 1             | $X_1$     | $X_3$ (0.3715)                               | 18.66%                                                   | Retained $X_1$               | 0.0831  |
| 2             | $X_2$     | $X_3$ (0.2148)                               | 29.44%                                                   | Retained $X_2$               | 0.1079  |
| 3             | $X_3$     | $X_4$ (0.2122)                               | 40.10%                                                   | Retained $X_3$               | 0.0310  |
| 4             | $X_4$     | $X_7$ (0.1678)                               | 48.53%                                                   | Retained $X_4$               | 0.1066  |
| 5             | $X_5$     | $X_1$ (0.1654)                               | 56.84%                                                   | Retained $X_5$               | 0.1866  |
| 6             | $X_6$     | $X_{10}$ (0.1604)                            | 64.89%                                                   | Retained $X_{10}$            | 0.0432  |
| 7             | $X_7$     | $X_9$ (0.1473)                               | 72.29%                                                   | Retained $X_9$               | 0.0843  |
| 8             | $X_8$     | $X_{13}$ (0.1428)                            | 79.46%                                                   | Retained $X_{13}$            | 0.0504  |
| 9             | $X_9$     | $X_{11}$ (0.1104)                            | 85.00%                                                   | Retained $X_{11}$            | 0.0740  |
| 10            | $X_{10}$  | $X_6$ (0.1004)                               | 90.05%                                                   | Retained $X_6$               | 0.0806  |
| 11            | $X_{11}$  | $X_6$ (0.086)                                | 94.37%                                                   | Removed $X_6$                | 0.0554  |
| 12            | $X_{12}$  | $X_3$ (0.0618)                               | 97.47%                                                   | Removed $X_3$                | 0.0253  |
| 13            | $X_{13}$  | $X_{12}$ (0.0504)                            | 100.00%                                                  | Removed $X_{12}$             | 0.0717  |

*Note.* The weights in the last column correspond to the indexes in the second column.
measures, being kind to others, values, driving control behaviour, situation foresight, common sense regarding machinery, precautionary measures, knowledge of laws and regulations, self-management behaviour, and safe and civilised behaviour. Through combining various texts, this article summarizes the indexes that can comprehensively reflect the level of driver traffic literacy and lay a specific theoretical basis for further research on the evaluation index system of driver traffic literacy.

The research method proposed in this paper excludes the indexes with overlapping information. During the index screening process, the concept of information contribution sensitivity was proposed. Its value is obtained by calculating the sum of the difference operation result of the retained principal component to an index and the cumulative contribution rate of the principal component variance corresponding to this index. Each index is weighted by the ratio of the information contribution sensitivity of one index to the sum of the information contribution sensitivity of all indexes, so the index's weight can genuinely reflect the corresponding index's information content. It overcomes the shortcomings that existing research cannot use the principal component analysis method to complete the empowerment and makes the weights of various indexes more objective and expands scientific methods other than subjective empowerment.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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