

Three Dimensional Structure Model of Teachers' Information Needs with Different Information Interaction Styles

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Abstract: - As an organic whole with certain external connection and internal structure, information demand is restricted by social factors as well as individual factors because of its special stipulation. Under the combined action of different factors, the structure of information demand presents a dynamic changing process and various basic states. Different forms of information interaction style model and information requirement model are determined. According to this complex representation, a three-dimensional structure model is presented. On the basis of this model, the correlation among information requirement process stage, cognition and emotion is studied. The experimental results show that information requirement is excessive. The reliability and validity of the model are very high among process stage, cognition and emotion, and the result of the model is compared with the result of expert evaluation. The result of analysis is almost the same as that of expert analysis, which indicates that the three-dimensional structure model of teachers' information needs with different information interaction styles has certain application performance.

Key-Words: - Different information interaction; Teachers' information needs; Three-dimensional structure; Model building

Received: September 2, 2022. Accepted: October 2, 2022. Published: October 11, 2022.

1 Introduction

As a very influential and new medium of information dissemination and communication, network plays an important role in promoting the change and development of users' information behavior. In such a brand-new media environment, users' information behavior seems to have undergone essential changes. Therefore, the mastery of users' information seeking ability and strategy has become a breakthrough to improve their digital literacy in the network era. As the leading force of this revolution, teachers' information acquisition strategies and skills play an important role in their professional development and the cultivation and improvement of students' digital literacy. Therefore, how to make full use of these dynamic and diversified digital resources to enrich and improve themselves, and then make themselves competent for this sacred and challenging teacher responsibility, seems to become one of the key issues related to teachers' professional development and basic education curriculum reform.

In the process of information demand, teachers, as a special group, will encounter many problems different from those of other professions. What challenges and problems will they face in the process of acquiring information related to work, teaching and learning, and how these challenges and

problems will be solved, are an integral part of their information-seeking behavior; he mastery of information acquisition skills greatly affects teachers' learning and teaching performance; and the speed of their professional development has a direct impact. Research shows that many front-line teachers will face many problems that they cannot solve in the process of obtaining the information they need quickly and efficiently.

1.1 Domestic Research Status

Wang et al. found that in the process of information demand, teachers will face some problems in the following aspects, such as determining search keywords, judging search results and regulating the process of information search [1]. The research on teachers' information-seeking behavior is the basis for the research and cultivation of their information-seeking strategies and abilities. Therefore, the research on teachers' information-seeking behavior has become a breakthrough for teachers' information-seeking strategies and skills. Information interaction style is defined as the behavior and attitude displayed by individuals in the process of disseminating and interacting with new information. Teachers with different ways of information interaction may face different challenges and show different characteristics in the

process of information seeking. However, few people pay attention to the information seeking behavior of teachers with different information interaction styles, such as the channels for teachers with different information interaction types to obtain information, and the aspects involved in their information seeking process. In this process, teachers' cognition and emotion change in different ways of information interaction. This will lead to a significant reduction in the effectiveness of information.

1.2 Overseas Research Status

The three-dimensional structure model of teachers with different styles of information exchange has been studied relatively early in foreign countries. The typical three-dimensional structure model which has been widely used is as follows: Hu et al proposed that the three-dimensional structure of university teachers' teaching includes five dimensions: using various teaching styles, maintaining effective teacher-student interaction, maintaining a positive learning environment, maintaining a good learning environment and maintaining a fair and consistent order [2]. Horne suggested that the three-dimensional structure model of style teachers consisted of six dimensions, namely, academic skills, planning skills, management skills, communication skills, evaluation and feedback skills, and interpersonal skills [3]. Batle believed that the teaching ability of style teachers generally consisted of 4 dimensions [4]. The four dimensions consist of teachers' professional and technical knowledge, curriculum design ability, communication ability with students and teachers' ability of teaching implementation and management. Weber argues that teachers' teaching competence includes three dimensions: competence composition, organizational level and teaching field [5]. However, the above methods are relatively extensive and do not apply to the demand for different information in China.

Based on the shortcomings of the above methods, this paper studies the three-dimensional structure model of teachers' information needs under different information interaction modes. There are four types of information interaction in the information interaction style model: hesitation, preemption, immersion and consciousness; Information demand models include Kuhlthau model, Alan Forster's nonlinear information demand model, and a review of information demand process model; The three-dimensional structure of information demand includes the cognitive structure, utility structure and

content structure of information demand. The experimental results show that the model is highly effective in the process stage, cognitive stage and emotional stage, and is compared with the expert evaluation results. The analysis results are basically consistent with the expert analysis results, indicating that the method in this paper has a certain technical level and practicality. The purpose of this paper is to systematically study the information seeking behavior of teachers who meet different information interaction modes in the process of dynamic and diverse network environment, and lay a foundation for the design and development of teacher education learning materials and information acquisition systems.

2 Research on Three Dimensional Structure Model of Teachers' Information Needs With Different Information Interaction Styles

2.1 Information Interaction Style Model

Information Interaction Style Model (IISM) is a theoretical model that supports measuring the learning performance and information interaction of users in a dynamic and diverse learning environment using resources such as networks. The model (shown in Figure 1) consists of two kinds of communication activities, namely "inquiry" and "construction". The construction activity is located in the vertical dimension and the inquiry activity is in the horizontal dimension. Construction activities depend on the level of immersion in educational practice. Individuals are in the two dimensions of inquiry and construction, so they seek new information, sort and share it with others. Seeking and screening behavior is the expression of inquiry, while sequencing and sharing behavior are the manifestation of construction.

Construction (from fuzziness to clarity) and inquiry (from closed to open) are the dissemination activities of information interaction style models. According to the individual's degree of immersion in seeking new information, screening among different alternative information, sorting information related to constructions and sharing information with others, the individual is at a certain point in the two dimensions of construction and exploration. Seeking (behavioral activity) and screening (cognitive activity) are information practices related to inquiry communication activities, sorting (cognitive activity) and sharing

(behavioral activity) are information practices related to constructive communication actions. The operation dimension of the information interaction style model is shown in Figure 2.

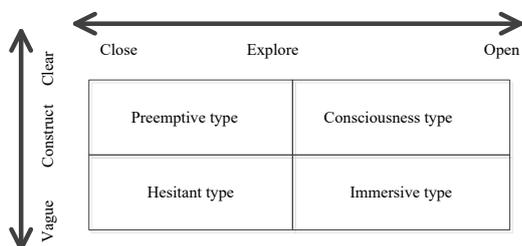


Fig. 1: Information interaction style model

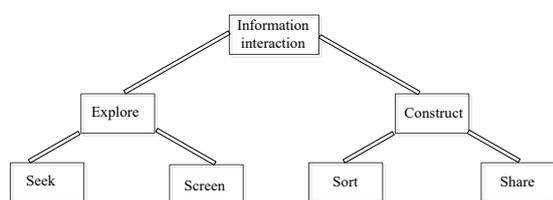


Fig. 2: Operational dimension of information interaction

The model includes four types of information interaction: hesitant, preemptive, immersive and conscious (as shown in Table 1). These four information interaction styles are described as behaviors and attitudes of individuals associated with the dissemination and interaction of new information [6].

1) Hesitant type: individual construction and inquiry are at a lower level. They are often unable to explore and seek new information to cope with the difficulties of modern life, nor to explore and construct the importance of life experience, so they may be able to implement information seeking, filtering, sorting and sharing practices at a very low level of concern.

2) Immersive type: low level of individual construction, but high level of inquiry. They do not construct and consider other choices and opportunities, but are able to obtain new information to meet the challenges of modern life; they seek and screen at a high level, but rank and share at a relatively low level; they will choose enough sources and channels to illustrate the complexity of modern life, but will not construct or reconstruct the meaning of life experience, therefore, they are not lifelong learners.

3) Preemptive type: the level of individual construction is high, but the level of inquiry is low.

They construct or reorganize different choices and opportunities, but rarely explore enough new information to cope with the difficulties of modern life. They seek and sift for new information at a relatively low level. Despite the high level of ranking and sharing, they do not use enough sources and channels to measure and compare the complexities of modern life completely in depth, but reconstruct the meaning of life experience.

4) Consciousness type: individuals are at a higher level in the two dimensions of inquiry and construction. They can not only explore and acquire enough new information, but also construct and think about other alternative opportunities to address the challenges of modern life. In the four kinds of information practice of seeking, screening, sorting and sharing, the individual level is relatively high. They can not only use enough information sources and channels to obtain new information to cope with the current difficulties, but also reconstruct the meaning of life. They are lifelong learners.

Table 1. Comparison of four interactive style teachers

| | Exploring (seeking and screening) | Construction (sorting and sharing) | Challenges / difficulties in modern life | Whether to construct the meaning of life experience |
|--------------------|-----------------------------------|------------------------------------|--|---|
| Hesitant type | Low | Low | Unable | No |
| Immersive type | High | Low | Able | No |
| Preemptive type | Low | High | Unable | Yes |
| Consciousness type | High | High | Able | Yes |

2.2 Information Demand Model

2.2.1 Kuhlthau Model

Kuhlthau put forward the theory of information search process, which includes seven stages: starting, referring to the beginning of information needs awareness; selection, referring to the selection of research purposes; exploratory period, first investigating the general literature situation, in order to increase preliminary understanding; form a focus, from the information obtained to determine views and topics; collection, referring to collect information related to focus topics; presentation, completion of data collection; collaboration and evaluation. At each stage, three categories of human experience are integrated, which are, emotion, cognition and action. Emotionally, in the initial stage of information search, the searcher will be full

of uncertainty, but with the clear direction of the subject, it will gradually begin to feel optimistic. However, with the increase of access to literature, there will be confusion and frustration. In the process of information acquisition, with the determination of the research topic, the searcher will have a sense of clarity. In the final stage of data collection, the searcher will develop a sense of direction and confidence, and evaluate the information obtained, that is, satisfaction or dissatisfaction. Cognitively, the searcher shifts from focus blurring to focus clarity and concentration, and his interest increases during the search process. In action, information is sought to get appropriate information. In this model, the information search process has to seek a wide range of relevant information and gradually become the screening of appropriate information. Although this model does not indicate whether emotion and cognition affect behavior, it can clearly see the changes of cognition and emotion. At the same time, Kuhlthau points out that information seeking behavior is composed of emotion, cognition and action.

2.2.2 Alan Forster's Nonlinear Information Demand Model

Foster believes that information needs are not linear, and not a linear process composed of specific stages and interactive activities in a particular situation. On the basis of assimilating the advantages of natural research methods, he constructed a nonlinear model of information demand through empirical research. The model consists of three core processes: initiation, orientation and integration, and the interactions among three levels of situations are: internal situation, external situation and cognitive method. Each level of interaction involves special activities and characteristics. This dynamic, diverse, non-linear, historical interaction properly reflects the user's information needs behavior characteristics, that is, the user's information needs are very similar to the artist's palette - dynamic, which is non-linear, variable, and time-varying. It explains the user's information seeking process in a unique way, which reflects the experience of information seekers. The three core processes of information seeking behavior and their three levels of scenarios interact and depend on each other, and each element is composed of its own different sub-elements. Therefore, when one of the elements changes, the other elements must also change.

2.2.3 Comment on Information Demand Process Model

The above two models carry out deep research on users' information seeking process and behavior from different aspects. Kuhlthau's information search process model is regarded as a universal model in the field of information science, which is suitable for all fields. The model describes the process of information seeking as "the actions taken by individuals in the process of obtaining or evaluating information to meet information needs, and the corresponding changes of cognition and emotion in the process". These two models are obtained through long-term empirical research, and play a great role in promoting the development of information science. Although the model describes the changes of cognition and emotion, there is little research on the intricate relationship between cognition, emotion and action.

Foster's non-linear model of information-seeking behavior pays more attention to the impact of scenarios and experiences on users' information-seeking behavior. Foster re-examines the issues involved in information-seeking behavior from a socio-cultural and historical perspective. This model represents a historic change in the study of information seeking behavior, that is, from linear jump to nonlinear, thus providing a new thinking tool for explaining complex, dynamic and diverse user information seeking behavior, and for integrating information science with other disciplines; at the same time, the model also implies many previous studies. The hypothesis not involved in the study provides a new platform and foundation for further expanding the field of information science.

Through in-depth analysis of the above models, we can find that these models have conducted a systematic and in-depth study of the user's information demand behavior models from their own single and unique perspectives, so that we have a relatively clear understanding of the user's information seeking behavior. But up to now, few studies have focused on the process of teachers' information needs, especially the information needs behavior of teachers with different information interaction styles. Therefore, how to learn from the current information seeking behavior model to study the information needs of teachers with different information interaction styles has become a challenging but promising subject. So that we can have a comprehensive and in-depth understanding of them, and then lay the foundation for the design of teachers' professional development and

information acquisition system, in order to improve teachers' information needs skills and methods. The specific research issues are as follows: the characteristics of information needs methods of teachers with different information interaction styles, the characteristics of information needs process of teachers with different information interaction styles, the correlation characteristics between information needs process stages, cognition and emotion.

3 Three Dimensional Structure Model of Information Demand

As a kind of social demand, information demand is an organic whole with certain external relations and internal structure [7]. In the complex structure function of different factors, the information demand structure presents a dynamic structural process. Under different environment conditions, there are different information states, various basic states and different forms of expression determined by them. Based on the understanding of the nature of information demand, it shows the complexity of the internal structure of information demand. This complexity can be summed up into three-dimensional structure: the cognitive structure of information needs, the utility structure of information needs and the content structure of information needs.

3.1 Cognitive Structure of Information Needs

Because of the restriction of human characteristics and environmental conditions, the subject of information needs has subjectivity and cognition. Therefore, the user needs cannot be expressed directly and accurately. In fact, there are three basic levels, that is, the objective state, cognition state and expression state of the user's information needs.

If the cognition state of information demand is called subjective demand, then the change of information demand state has the following law. When the subject completely matches the objective information demand with the subjective information demand, that is, the objective information demand of the user is fully understood by the subject, the state of the information user's demand can be accurately revealed. When the subject only recognizes a part of the objective information demand, the state cognition of the information demand is partial, incomplete, and the main part of the objective information demand is not recognized by the user subject, that is, the teacher has a

substantial response to the information demand, and the information demand is in a latent form.

The first situation is ideal, which can basically be realized; the second situation is normal, is the level which we usually say the information needs, and is in a state that reflects part of the objective information needs; the third is precisely the direction of the joint efforts of information users and information service personnel, which can only be transformed from latent form to explicit form. Obviously, the three levels of demand are decreasing in sequence. Influenced by many factors, it is impossible for users to be completely consistent in their understanding, expression and objective needs. There is a long way to go from objective needs to real needs. There are many times when information users do not realize their information needs even when they encounter setbacks in their work. The existence of information awareness depends on the quality of the users themselves and the stimulus of the outside world. The transformation of demand also needs environmental constraints. Some of the realized needs still cannot be translated the real demand into reality.

3.2 Information Demand Utility Structure

As mentioned before, since the information needs have certain subjectivity and dependence with the outside world, it is natural that the judgment of information utility and value should be included in the composition of information needs, otherwise, it is difficult to reflect the interdependence between style teachers and information. In this structure, the utility level of information needs does not increase strictly in accordance with Maslow's needs, and the individual cognitive level of the style teacher is also an important factor. Moreover, owing to the inertia of human nature and the existence of socioeconomic reasons, Old ford's hierarchy of needs theory from high to low seems to have more practical rationality. In most practices, users are not able or willing to distinguish the utility hierarchy completely in the analysis of the utility structure of each information demand. Most of the time, users use the simplest but most effective value judgment, that is, cost and benefit effect. The maximum profit after the information utilization can be exchanged with the minimum cost often becomes the principle that the user's demand utility structure is tried and tested repeatedly.

3.3 Content Structure of Information Needs

Due to the complexity of human social practice, the information needs of stylistic teachers will show a

variety of characteristics [8]. Not only different types of styles have different characteristics of teachers' information needs, but even the same type of users have different information needs because of the different psychological characteristics, cognitive ability or information environment. Generally speaking, the information needs of users are mainly manifested in two parts.

3.3.1 Demand for Information

The demand for information itself is the ultimate goal of the style teachers' information needs. People engage in practical activities, just using information to expand their understanding of things, so as to better transform the world and serve them. Therefore, human's demand for information is essentially manifested as human's pursuit of information and knowledge. Due to the many attributes of information itself, teachers' requirements for information also involve many aspects, such as the requirements for information content. No matter how many forms the teachers' information needs are, the essence is to ask for specific information content, which is helpful to solve the problem. It can be said that the demand for information content is the most important manifestation of information needs. To satisfy the quality requirement of the teachers, a certain amount must be guaranteed, the information is complete and needed, the complete requirement, the reliability and accuracy also need to be accumulated and identified, but there is usually a certain degree of problem in dealing with the amount of information, excessive information will only affect the judgment of information users, and cannot satisfy its legitimate needs.

3.3.2 Demand for Stylistic Teachers' Information Service Process

The increasing amount of information and the complexity of social activities make personal information processing ability difficult to cope with and needs to seek help from information service institutions. In fact, teachers' demand for information service is indirect demand for information; information service is only an intermediary means. There are usually several requirements for information services:

For the demand of information service mode, teachers with different styles need different information service modes, such as retrieval service, consulting service, loan service, and replication service. Retrieval service: a kind of information service that is provided to teachers with the help of

specialized personnel according to their needs; Consulting services: teachers raise problems or difficulties, service subjects give suggestions or solutions, and both parties agree on their responsibilities and obligations through agreements; Borrowing service: teachers borrow the required resources through the service place; Copy service: circulation and transmission of information service by means of resource copy. The demand for service facilities includes retrieval equipment and reading places; and the demand for service quality includes timeliness, pertinence, ease of use and continuity. In a word, to satisfy the information service process is to realize the content value of information more effectively. It has become an indispensable part of the realization of information value [9]. With the development of information technology, it is more and more difficult to distinguish the needs of content and service mode, that the two are gradually integrated. Advanced service environment and technology platform are the necessary guarantee for users to understand and obtain information content effectively. The value realization of information content will be greatly discounted without the training and experience process of efficient and humanized service environment.

It should be pointed out that [10], the three-dimensional structure of information needs cannot be completely separated, when a specific information requirement is generated, the three-dimensional structure actually coexists interactively, and cognition affects both utility and content. On the contrary, the satisfaction of utility needs and content needs will stimulate the promotion of cognitive needs. At the same time, this mixture is a dynamic one. When the subjective and objective conditions of the teachers change, it will affect the change of structure, and then affect the change of demand.

4 Results

In order to validate the comprehensive validity of the three-dimensional structure model of teachers' information needs with different information interaction styles, an experiment was conducted. Five different school-style teachers in China were surveyed by means of online questionnaire. The teachers' ages ranged from 25 to 40 years old. A total of 180 questionnaires were sent out and the actual responses were given. 172 questionnaires were collected, accounting for 95.56% of the total number of questionnaires. 19 questionnaires were invalid except for blank papers and incomplete

answers. Among them, 153 valid questionnaires were collected, accounting for 85% of the total number of questionnaires.

Firstly, the respondents should rank the same level of indicators according to their importance and mark the corresponding serial number. Secondly, according to the ranking results, the importance of the indicators is scored to evaluate the importance of the indicators in the whole index system. The scoring method used Likert 7 scale, in which the respondents thought that the index was "indispensable and unimportant" and the respondents thought that the index was "essential". The Karen Bach coefficient is used to measure the consistency between the evaluation indicators. The value range of Cronbach coefficient is 0-1, and if the value of Cronbach coefficient is greater than 0.5, it shows that the model has a good reliability. If the value of Cronbach coefficient is greater than 0.9, it shows that the model has a very good reliability. The Cronbach coefficient is recognized in the information demand process, as shown in Table 2.

Table 2. Emotional analysis results of teachers' information needs process and information needs process

| Cronbach coefficient | Items |
|----------------------|-------|
| 0.8559 | 1 |
| 0.9510 | 2 |
| 0.8221 | 3 |

Validity means that the tool can measure the nature of the content to be measured, and validity is more important and comprehensive than reliability. "Structural validity is also called concept validity, that is, to what extent the test accurately verifies the theoretical concept of test preparation." Using the SPSS 7.0 (Chinese version) option of "analysis-dimension reduction-factor analysis", the evaluation index of inquiry ability in the study was analyzed to test the structural validity of each index.

Factor analysis is a statistical analysis method, which mainly studies extracting common factors from variable groups, using a few factors to describe the relationship between many indicators or factors, reflecting most information of the original data. To test the structural validity of the index by factor analysis, the KMO value and Bartlett spherical test must be done first. According to the research conclusion, the value of KMO is between 0 and 1, the closer to 1, the higher the correlation between variables. $KMO > 0.9$, indicating that the effect is very good; $KMO > 0.8$, the effect is very good; $KMO > 0.7$, the effect is still acceptable, 0.6 is general, below 0.5 is not recommended to do factor

analysis. Bartlett test is the independence between variables, when the probability of chi-square test is less than 0.05, indicating that the variables are not independent, there is a significant correlation, and the factor analysis can be done. If the KMO value is too small, or the probability of testing is greater than 0.05, it is better not to do factor analysis, because the factors are not representative. If it is suitable, the principal component analysis should be continued. If the cumulative explanatory variance is more than 60%, the result of factor analysis is ideal. If it is more than 40%, the result of factor analysis is acceptable.

Factor analysis was used to check the structural validity of the questionnaire on the primary evaluation index. KMO and Bartlett spherical test were used to test the possibility of factor analysis. If possible, the common factor was extracted by principal component analysis and the total variance was obtained. If the cumulative variance was greater than 60%, the questionnaire was confirmed. The structural validity of the theoretical construction is good, and the concrete results are as follows:

Table 3. Analysis of construct validity of primary indicators for kmo and bartlett test

| | | |
|-----------------------------|---------------------------|---------|
| | Kaiser-Meyer-Olkin metric | 0.82 |
| | Approximate chi square | 362.412 |
| Sphericity test of Bartlett | df | 22 |
| | Sig | .000 |

The three-dimensional structure model of teachers' information needs with different information interaction styles is used to analyze the results of the questionnaire, and the results are compared with the results of expert analysis. The abscissa coordinates are the corresponding teaching modes of five universities, the ordinate coordinates are the three-dimensional structure index of style teachers' information needs, and the unit is C.

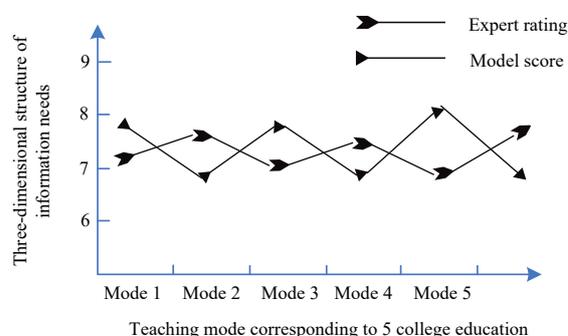


Fig. 3: Comparison of three dimensional structure index scores of different styles of teachers' information needs

It can be seen from Figure 3 that the scores of teachers' information demand 3D structure models with different information interaction methods in this paper are basically similar to the results of family analysis, and the maximum difference of 3D structure index scores is about 1C, which indicates that the model structure in this paper has certain technical level and practicability.

5 Discussions

1) According to the analysis table 2, the Cronbach coefficients between teachers in the process of information demand, emotion in the process of information demand and cognition in the process of information demand are 0.8559, 0.9510 and 0.8221, respectively, which show that the internal consistency is quite high and the reliability is very high.

2) According to Tables 3 KMO value is 0.82. Factor analysis has a better effect, there are four factors whose eigenvalues are greater than 1, and the cumulative explanatory variance is 73.321% or more than 60%, which is an ideal result, indicating that the structure validity of the evaluation index is better.

3) The analysis results of the three-dimensional structure model of teachers' information needs with different information interaction styles are almost the same as those of the experts, which shows that the three-dimensional structure model of teachers' information needs with different information interaction styles has certain application performance.

6 Conclusions

In the process information needs, teachers are a special group, will encounter many problems different from those of other professions. In the process of acquiring information related to work, teaching and learning, information interaction style is defined as the behavior and attitude displayed by individuals in the process of disseminating and interacting with new information. To a great extent, it affects the information needs of users. Teachers with different information interaction styles have different information needs. Different challenges may be faced in the process. According to this complex representation, a three-dimensional structural model is presented. On the basis of this model, the correlation among the stages of information demand process, cognition and emotion is studied. The experimental results show that there

is a high reliability and validity among the stages of information needs, cognition and emotion. Compared with the result of expert evaluation, the result of analysis is almost the same as that of expert analysis, which shows that the three-dimensional structure model of teacher's information needs with different information interaction styles has certain application performance. This model is applicable to teachers' information seeking in different information interaction modes in China. It is expected to help teachers' information needs and lay a foundation for the design and development of teacher education and learning materials and information acquisition systems. However, in the process of experimental investigation on the effectiveness of the three-dimensional structure model of teachers' information needs with different information interaction methods, due to the time-consuming, labor-intensive and complex way of questionnaire investigation, the experimental investigation time did not reach the expected effect and the efficiency was reduced. In the following research, it will be improved to shorten the experimental investigation time and improve the efficiency.

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