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Research Article

Continuance Intention Mechanism of Middle School Student Users on Online Learning Platform Based on Qualitative Comparative Analysis Method

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The research on the users' continuance intention behavior of online learning platforms is not a new topic. In the past, more studies were conducted on users of MOOC online learning platforms, which are based on symmetric causality. This study adopts the qualitative comparison analysis method to build configuration model by combining platforms, students, parents, teachers (4 level seven elements) with middle school students' continuance intention. The configuration analysis identifies the user' retention path of middle school students on online learning platform under the collaborative influence of multi-level elements, summarizes the online learning platform of continuance intention mechanism and implementation path for middle school students and reveals that the users of online learning platform for middle school students keep clear of the mechanism of action and realistic choice. In the end, the user retention mechanism of middle school students' online learning platform is summarized, including platform quality orientation, platform interaction orientation, and "parent-teacher" dual drive.

1. Introduction

With the development of information technology, especially the popularity of mobile Internet terminal devices, and the spread of COVID-19, online learning has become one of the common learning methods for middle school students. In the past, most studies focused on the influencing factors of single-level users. In fact, for middle school students' online learning, its continuance intention are affected by many level factors. The research of single-level elements often follows deductive logic and hypothesis test, which is suitable for the analysis of net effect relationship at the variable level. The research on the continuance intention of multi-level elements for middle school students is based on abduction logic to identify the configuration causes of specific results (such as continuance intention), which is suitable for the research on the complex relationship of hierarchical configuration shaping continuance intention behavior [1]. Based on the perspective of level-element configuration, combined with

Fs-QCA (fuzzy set Qualitative Comparative Analysis) method, this paper analyzes the necessary and sufficient causal relationships [2], explores the causes of level configuration of results (continuance intention) according to abduction logic, and then obtains the path of middle school students' continuance intention behavior.

2. Research Basis

2.1. Community of Inquiry. Community of Inquiry (CoI), is a valid theoretical framework for the study of online learning cocreated by Garrison and Arbaugh [3]. This theory mainly emphasizes the importance of interaction between teachers and students or between students and students in the process of online learning, and aims to promote the construction of students' knowledge, the discovery of students' ability and the cultivation of students' skills under the teachers' feedback when students learn online. The theory can be divided into cognitive

presence, social presence and teaching presence. Cognitive presence which considers students as the main object, takes advantage of their own learning efficiency and learning engagement to explore learning tasks, to integrate the application of solving problems, thus obtaining the acquisition and application of advanced knowledge. Social presence means students display their personal characteristics in the trustworthy inquiry learning community through communication media, so as to interact with others, realize the purpose of developing interpersonal relationships, and enrich their social interaction experience. Teaching presence is the design, promotion and guidance of students' cognitive processes, including curriculum design and organization, facilitating dialogue and direct teaching, in order to achieve personally meaningful learning results. In the theory, the main subject of cognitive presence is students, while parents only participate in online learning process as supporters and supervisors, mainly to check the completion of its task. Social presence and teaching presence both require parents to guide and help students in family education environment. The significance of the above theory for this study mainly lies in students' self-learning efficacy and the performance of observing students' perception of parental involvement in online learning.

2.2. Overlapping Spheres of Influence. The theory of Overlapping Spheres of Influence was proposed by Epstein based on the ecological theory of school-family relationship, to establish family-school partnership, mainly the one between school, family and community [4]. In this study, the theory of community is defined as the online learning platform, on which the collaborative relationship is expected to be based on. Through the method of online study, the family, school, and platform establish the same goal for the children's occupational planning, undertake the common task and establish a new type of cooperative relationship between the student, family and school. To sum up, users' continuance intention of using online learning platforms is a dynamic process that covers multiple factors such as macro environment and micro-individual characteristics, and this process is affected by many precursors, including family, school, platform and individual characteristics [5–7]. In particular, compared with adults, there exists a realistic situation of "middle school students-parents" role separation. However, existing studies are often limited to a certain level, which ignores the possible influence of multiple factors concurrency on users' continuance intention behavior in the context of role separation, leading to the inconsistency of existing conclusions [8]. The internal mechanism of multi-level synergy affecting users' continuance intention of online learning platform remains unclear. In view of this, this study integrated four levels to explore the multiple concurrent factors and causal complex mechanism.

3. Relationship and Research Model between Level Factors and Continuance Intention

3.1. Relationship between Student-Level Factors and Continuance Intention

3.1.1. Relationship between Online Learning Self-Efficacy and Continuance Intentio. The concept of "online learning self-efficacy" is derived from the concept of "self-efficacy" proposed by Bandura. From the perspective of its development, this concept has gone through the process of "self-efficacy," "learning self-efficacy," and then "online learning self-efficacy" [9]. It can be seen that he regarded it as a subjective cognitive variable of people's ability to complete a certain task. He regarded it as a key factor of human motivation system and explored its influence mechanism on individual behavior. With the deepening of research, many studies have clarified and expanded the role of self-efficacy as the basic mechanism for the change, maintenance and generalization of individual actions. The concept of "self-efficacy in learning" is just the application and development of "self-efficacy" in the field of learning. At the same time, he discussed the operation mechanism of self-efficacy in the process of learning, pointing out that learning motivation is discussed according to self-efficacy, that is, learners' judgment of their ability to perform specific learning behaviors. With the rapid development of information technology and the deepening of research, the study of "learning self-efficacy" has been gradually extended to the field of online learning, resulting in the concept of "online learning self-efficacy." In 2006, Pituch defined self-efficacy in the context of e-learning as learners' confidence in their ability to perform specific learning tasks using e-learning systems. Chinese researcher Guo Li et al. described it as "Learners' subjective judgment of their own network learning ability" [10]. Based on this, this study believes that the self-efficacy of online learning of middle school students will affect their continuance intention.

3.1.2. Reationship between Online Learning Engagement and Middle School Students' Continuance Intention. The word "input" originates from the research on input in the field of work. The researchers regard employees' engagement in the work environment as an internal psychological structure, and "engagement" refers to employees' total commitment to work. Although the environments and places where employees perform tasks are different, their underlying psychological structures are similar to some extent. Therefore, this paper introduces the concept of work engagement into the field of learning, resulting in the concept of "learning engagement." "Learning engagement" is described as "learners show an active and persistent state in the learning process, as well as a universal and persistent state." With the rapid development of online learning, the effect of middle school students' online learning has aroused widespread concern and discussion among researchers. More and more

researchers regard the level of learning engagement as an important indicator to measure the quality of online learning process, and a large number of studies have been carried out. As the online learning of middle school students is characterized by the situation of role separation, the importance of learning engagement for middle school students online learning is self-evident. Whether online learning can happen, whether it can be persevered and focused, and whether it can achieve good learning results is worth discussing. Based on previous research results, this study defined the concept of "online learning engagement" as "whether the online learning of middle school students can be sustained and focused is the performance of the online learning process of middle school students." Therefore, online learning involvement of middle school students will definitely affect their continuance intention behavior.

3.2. Relationship between Parent-Level Factors and Continuance Intention. The parents mentioned in this study refer to the parents of middle school students, or a small number of them are other guardians in addition to their parents. Parental participation means that parents pay attention to the learning process of middle school students, participate in the learning style of middle school students, affect the choice of learning style of middle school students, and then affect the learning effect. Parents' participation can be divided into in school educational activities and out of school educational activities according to their behavior. Parents' participation in school educational activities can be divided into direct participation and indirect participation. Direct participation refers to guiding students' after-school learning, assisting students to complete their homework, paying attention to students' psychological changes, providing material support and ensuring the learning environment. Indirect participation refers to understanding children's learning status through interaction and communication with teachers and other teaching staff, feeding back students' learning status to teachers, and helping children make progress in quality, study, behavior and so on. Parents' participation in extracurricular educational activities includes learning habit formation, learning method training, quality improvement etc. The behavior of participation can be divided into direct participation and indirect participation. Direct participation refers to parents' tutoring their children's homework at home; indirect participation means that parents provide conditional support for their children's learning, including high-quality learning resources and valuable guidance. In this study, parents' participation in children's online learning mainly refers to parents' support or involvement in the learning process of middle school students, which affects the learning effect. Participation usually includes time companionship, necessary supervision, material supply and emotional encouragement and support. Therefore, parental participation will certainly affect the continuance intention of middle school students.

3.3. Relationship between Teacher-Level Factors and Continuance Intention. As a specific professional role behavior, teacher behavior not only has the common characteristics of human behavior, but also has the unique characteristics of teacher role. From the perspective of teacher quality, scholars Lin and others believe that teacher behavior is the external embodiment of a comprehensive quality such as teaching philosophy, teaching by example and teaching ability in specific teaching. The teacher behavior understood by Bai is sometimes called teacher performance [11]. Therefore, whether expressed by teacher behavior or discussed by teacher performance, they all express the implicit concept of teachers' internal quality through explicit behavior. The relativity of teacher behavior determines that whether they experience from the perspective of explicit behavior or from the perspective of implicit behavior, their object is always learners, which needs learners' real experience and perception to judge. The teacher behavior in this study is mostly replaced by teacher support behavior, which can better highlight the directivity and purpose of teaching behavior. In order to further standardize the research, teacher support behavior is defined as: Based on their own teaching ideas, teaching ideas, teaching experience and individual level, and with the support of external educational environment (including teaching materials, teaching tools, physical environment, etc.), teachers carry out teaching design and teaching management. A series of teaching activities, such as teaching evaluation, expressed through words, actions and expressions, which have an impact on students' instrumental guidance, knowledge guidance, emotional help and social interaction. It can be seen that the continuance intention of middle school students' online learning, if supported by teachers, will inevitably encourage students to continue to use it. Therefore, teacher support will affect the continuance intention of middle school students.

3.4. Relationship between Platform-Level Factors and Continuance Intention

3.4.1. Relationship between Platform Interaction and Middle School Students' Continuance Intention. In traditional communication and cybernetics, interaction refers to a process in which the receiver reads, understands, processes and gives feedback to the information obtained [12]. Nowadays, the concept of interactivity has been gradually used by other disciplines, and its meaning has also been more extensive. For the interaction, the current academic community has not given a unified definition. After close scrutiny and research, Cho and Leckenby believes that these interactions should be summarized as follows: there are three types of interaction: user-machine, user-user, and user-message. The interaction between users and devices was the research field that early scholars paid more attention to, which emphasized the human-computer interaction process [13]. In this study, it refers to the user's perceived satisfaction of teacher-student interaction and student-student interaction when using online learning platforms. In the traditional school-based education mode, teachers' attention and communication to students will positively affect personal learning effect to a certain extent. The higher the user's awareness of platform interaction, the problems will be

solved in time. When they have ideas, they can communicate happily. At the same time, their needs will be better met. Therefore, the interaction of the platform will definitely affect the continuance intention of middle school students.

3.4.2. Relationship between Platform Service Quality and Middle School Students' Continuance Intention. Service quality is also an important variable in the success model of information system. Initially, it refers to the speed and effect of relevant operation and maintenance personnel to solve problems in the event of operation problems of information system. Combined with the actual situational characteristics of students using online learning platforms, this paper thinks that service quality means that when online learning platforms provide matched platform support (such as the timely response of the customer service, teaching assistant of the work on teaching etc.) for learning products (such as courses) and when the technical problems arise in the process of using the platform, the speed and quality of solving problems will affect middle school students' continuance intention. Therefore, the service quality of the platform will definitely affect middle school students' continuance intention.

3.4.3. Relationship between Content Quality of Platforms and Middle School Students' Continuance Intention. In this study, quality of content refers to the adequacy of learning resources on online learning platforms, the rationality of course arrangement, and the quality of relevant videos and materials. Related scholars have carried out studies in this field. Zhang et al. confirms that content quality can positively affect the expectation confirmation of users of online learning platform [14], while Yang points out that the more satisfied MOOC users are with course quality and auxiliary effect, the higher users' perceived ease of use and expected confirmation are [15]. Rich content quality can better meet the expected needs of users, while reasonable course arrangement and high-quality audio auxiliary materials can enable users to better experience the information system, that is, users' perception of the content quality of the platform can affect users' continuous use. Therefore, the quality of the platform content will definitely affect middle school students' continuance intention.

3.5. Research Model. The middle school students' continuance intention on online learning platforms is not a single and direct influence, but the result of many causal conditions. Therefore, this paper uses Qualitative comparative analysis (QCA) to conduct in-depth research and discussion on this issue. The QCA method proposed by Ragin, an American scholar, in the 1980s, explored how the combination paths of different antecedent variables affect the outcome variables, based on the cross-case comparison between qualitative and quantitative methods of Boolean algebra and set theory [16]. Therefore, it is of good applicability and scientific to apply the configuration view and holistic view of QCA analysis method to the research of students' continuance intention on online learning platforms. The relationship mechanism between antecedent variables and outcome variables is explored through analysis from a configuration perspective. The specific configuration analysis research model in this chapter is shown in Figure 1.

4. Research Design and Data Collection

4.1. Research Design. The subjects of this study are paired (parent-student). According to the characteristics of the research problem and the three characteristics of qualitative comparative analysis: conjectural causation, equifinality and causal asymmetry, fuzzy set qualitative comparative analysis (Fs-QCA) is chosen as the main research method in this study. In this study, semistructured interview and fuzzy set qualitative comparative analysis are used to determine the conditional variables and outcome variables of the configuration response. First of all, interviews are conducted with middle school students and parents who use online learning platforms, and the obtained data are analyzed to further summarize and refine their respective influencing factors. Secondly, interviews are conducted with middle school students and their parents who frequently used online learning platforms in the past 12 months. Finally, based on the interview results, the Fs-QCA3.0 software is used for configuration, and the configuration analysis model of high continuance intention is constructed.

4.2. Research Method. Qualitative Comparative Analysis (QCA) was first proposed by Ragin, an American social scientist, in the 1980s, and is a research method combining Qualitative and quantitative Analysis [17]. The basic idea of qualitative comparative analysis method is to apply set theory and Boolean to explore how the combination of antecedent conditions affects the results, aiming at solving the phenomenon with complex causal relationship.

Different from the traditional quantitative analysis method, the qualitative comparative analysis method thinks whether the result occurs is the result of the comprehensive action of different factors on the basis of examining the net effect of factors, and calls the combination of various factors "configuration." As the cornerstone of QCA method, configuration thinking is used to analyze results along the whole and system approach, that is, case-level configuration is adopted instead of single independent variables. QCA integrates the advantages of qualitative analysis and quantitative analysis to some extent. QCA solves causal complexity problems that large sample analysis cannot solve through overall configuration analysis. It is not only suitable for small sample studies with less than 15 cases, but also suitable for large samples with more than 100 cases. As a research method different from quantitative and qualitative research, QCA has gradually been recognized by economic management scholars at home and abroad [2].

Qualitative comparative analysis methods generally include several steps: calibrating variables, generating matrix, essential analysis, counterfactual analysis, and solution.
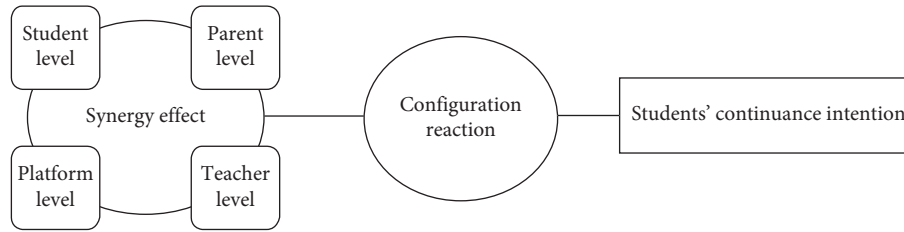
FIGURE 1: Configuration analysis model.

(1) Calibrate variables: QCA uses direct or indirect calibration to transform antecedent factors and interpreted results into aggregate data. Fs-QCA adjusts fuzzy set variables to be assigned to the closed interval from 0 to 1 by calibration. In Fs-QCA, calibration needs to set three critical values according to the actual needs, namely, the complete membership point, the complete nonmembership point and the crossing point, according to which to calibrate the antecedent conditions and the standards of the interpreted results in each set.

(2) Generating matrix: according to the "set-subset" relationship, the relationship between antecedent factors and explained results is explored and analyzed to find the corresponding combination of antecedent conditions and generate matrix. The combination of antecedent conditions for the explicitable results in the matrix of all potential configurations is analyzed based on set consistency and case frequency.

(3) Essential analysis: to determine the extent to which the configuration is a sufficient and necessary condition for the result variable, and to explain the explained result, QCA reflects through consistency and coverage. Generally, the consistency is greater than or equal to 0.75 and the coverage value is between 0 and 1, which is considered acceptable.

(4) Counterfactual analysis and solution: in order to avoid possible complex solutions, QCA also needs to conduct counterfactual analysis on the configuration to arrive at parsimonious and intermediate solutions. Among them, the antecedent conditions involved in both the reductive and intermediate solutions are the core conditions, and only the antecedent conditions in the intermediate solutions are the auxiliary conditions. In the current research on QCA method, Marx and Dusa stipulated the relationship between the number of influencing factors and the number of samples of Cs-QCA based on data simulation [16].

4.3. Data Collection. The data collection of this study was completed from September 2020 to February in 2021. The respondents of semistructured interviews were middle school students and parents who frequently used online learning platform products in the last 12 months. Firstly, the author and the research group selected 4 middle schools in Zhongshan District, Xigang District, Ganjingzi District and high-tech zone of Dalian, and randomly selected 10 pairs of students and parents who kept using the online learning platform. Among them, students, as actual users of online learning platform, have personal experience and feelings about the use of online learning platforms. Parents, as decision makers and participants of online learning platform, determine the students' continuance intention of online learning platforms. The author and members of the research group interviewed these 10 groups from September to October in 2020. The average individual interview time lasted more than 30 minutes. The main information of the 10 groups of respondents is shown in Table 1.

During the interview, the interviewees were asked three kinds of questions through semistructured interviews: first, the learning characteristics of the interviewees and their use of the online learning platform; second, describe the adoption of online learning platforms, continuance intention, specific process of continuance intention, and describe the situation and feelings therein; third, list the factors that may affect the attitude of middle school students' parents on online learning platforms. The main purpose of asking questions is to inspire the respondents to describe the factors that promote the continuous intention of online learning platform users based on their own actual experience and feelings.

In terms of students, the interview content mainly includes four aspects: (1) middle school students themselves. It mainly includes their learning attitude, self-confidence, ability and time invested; (2) platform. Because middle school students have been using it for 12 months or more, the interview questions mainly focus on the content and service quality of the platform and the real-time interaction of the platform; (3) parents. The interview content is about whether online learning needs the company of parents and whether parents can provide help in case of problems etc.; (4) Schools. Considering that the teachers have a great impact on middle school students' online learning, the interview focuses on whether they need teachers' encouragement, help and support for online learning. Finally, the research group collected and sorted out 20 descriptive data.

Twenty valid descriptive data were processed. The data processing process is mainly divided into the following steps: first, sort out 20 descriptive data into text format and import it into NVivo system to start text processing of the data; Second, make use of the different node types provided by NVivo to create nodes, tree nodes, cases and relationships with different levels and connotations, and merge the

TABLE 1: Main information of the interviewee.S

Data number	Middle school (abbreviation)	Area	Number of interviews	Role/identity
001-006	ZXJNM	Zhongshan district	6	Student, parent
007-010	XGYHJ	Xigang district	4	Student, parent
011-016	GZZJEJ	Ganjingzi district	6	Student, parent
017-020	GXXYY	High-tech zone	4	Student, parent

description data with similar content to form data fragments for further analysis; Third, through the query function of NVivo, find the frequency and source of text data, count the material source value and reference point value, and filter and retain the data with material source value greater than 3; Fourth, the group function of NVivo is used to induce and refine the retained data. After many times of induction and refinement, the causal factors of multi-level factors and high continuance intention behavior of online learning platforms are finally obtained, including learning self-efficacy (SE), learning engagement (LE), interactivity quality (IQ), service quality (SQ), content quality (CQ), parental participation (PP), teacher influence (TI), and continuance intention (CI).

After the preliminary survey and interview, the large sample case survey of this study was concentrated between October 2020 and February 2021. In the formal case study, due to the epidemic situation, all data were collected by telephone and network, including semistructured interview by telephone and questionnaire distribution by network. In order to avoid the influence of common method bias, this study carried out program control in the questionnaire design and distribution: on the one hand, the anonymity and confidentiality commitment to the respondents were marked in bold on the questionnaire, and the psychological pressure of the respondents was reduced and the social approval deviation of the respondents is minimized by covering up stories when the questionnaire is distributed; On the other hand, in addition to Likert's five level measurement model, judgment questions and semantic difference questions were added in the questionnaire design to reduce the consistency motivation of the respondents.

A total of 400 groups were entrusted to contact students and parents through their head teachers. 400 groups of students and parents were interviewed separately by telephone, and 400 sets of questionnaires were distributed. Based on the combination of telephone interview records and manual screening of returned questionnaires, unqualified questionnaires with too many missed answers, nonstandard answers and obviously halfhearted answers were deleted. Finally, 300 groups of valid samples were obtained, and the effective rate of data collection was 75%. After sorting out interview records and questionnaires, they were marked and sorted for relevance. Firstly, independent sample T-test was performed on the data and the results showed no significant difference ($P > 0.050$). Secondly, Harman single-factor method was used to test the common method bias. It was found that the variance explanation rate of the first factor was 21.93% (lower than 50%), which verified that there was no significant common method bias in this study.

4.4. Data Calibration and Configuration Construction.

The data analysis process of this study is mainly divided into two stages: data calibration and configuration construction.

The first stage: data calibration. Based on the calibration method suggested by Rihoux and Ragin [17] and Fiss et al. [18], the influencing factors of each sample and the attribution degree of the interpreted results are calibrated. In this study, the causal factors of continuance intention and antecedent conditions of middle school students on online learning platforms are measured by 5-point Likert method. The fuzzy data set adopted in this paper, referring to the practice of Jia and Du [1], takes the upper quartile, the mean of the upper quartile and the lower quartile, and the lower quartile of the data of 7 antecedents and 1 outcome variable as the complete membership, intersection and complete nonmembership of the data set.

The second stage: configuration construction. Fs-QCA3.0 software is used to analyze the calibrated data. First of all, the necessary conditions of causal factors are tested. When the necessity of the current cause condition exceeds 0.9, the core condition is formed, indicating that the explanatory power of the result variable is strong and should be taken into account in the subsequent analysis. Secondly, Ragin's suggestions are taken into account in the selection of the threshold value of the consistency rate, and the threshold value of the consistency rate is set at 0.8. Finally, Fs-QCA3.0 software gives the solution based on Boolean algebra and set analysis operation, and draws the corresponding configuration table.

In order to ensure the robustness of the results, following the suggestion of Epstein [4], the consistency rate threshold is lowered to 0.75 in Fs-QCA3.0 software and the configuration construction is carried out again. Three new configurations are obtained, but the consistency rates of the three new configurations are all lower than 0.75, and there is no fundamental change in the interpretation of the results, so the configurations obtained in this study are credible. In addition, in view of the high proportion of female parents in 246 pairs of respondents (82.3%), in order to ensure that the conclusions of this study are not affected by parental gender, two samples with male parents ($n = 54$) and female parents ($n = 246$) are constructed respectively, and there is no significant difference in the results in terms of factors. Therefore, the configuration obtained in this study is not affected by the factor of parental gender.

5. Sample Description and Data Processing

5.1. Descriptive Statistics of Data.
In this study, Fs-QCA method is used to analyze the combination of antecedent conditions of students' continuance intention. Fs-QCA is

suitable for explaining which combination of conditions causes occurrence of consequences and which condition configuration causes lack of consequences. There are many antecedent conditions of students' continuance intention, and the causality of various antecedent conditions is complex, so it is suitable to use Fs-QCA method to study it. Based on a configuration perspective in this study, antecedent variables are selected from four aspects: student characteristics, platform characteristics, teacher influence and parent involvement, that is, learning self-efficacy (SE), online learning investment (LE), platform service quality (SQ), platform content quality (CQ), interactivity quality (IQ), teachers influence (TI) and parents participation (PP). The study variables included 300 cases. First, descriptive statistical analysis of variables conducted in this study to calculate the mean, standard deviation, maximum and minimum values of each variable. The above statistical indicators are shown in Table 2.

In addition, although the robustness of the analysis results of the QCA method has nothing to do with sample size, Rihoux and Ragin also suggest that "a good balance must be reached between the number of cases and the number of conditions, and the ideal balance state has no absolute numerical range and is mostly obtained through trial and error" [17]. However, there is still a lack of similar research on Fs-QCA. When the final sample size is 300, the probability of the results being affected by random data is 1%, which can clearly distinguish random data from real data and ensure the accuracy of the analysis results.

5.2. Data Calibration. Following the steps of the Fs-QCA method, first, we transform the values of the set consisting of antecedent variables and outcome variables, and set 3 critical values based on the actual conditions: complete membership, intersection, and complete nonmembership. After the transformation, the collective value is introduced between 0 and 1. With reference to previous studies, set 3 anchor points as the upper quartile of the sample data, the mean of the upper and lower quartiles, and the lower quartile. The calibration anchor points of the research variables are shown in Table 3.

Secondly, we constructed a truth table, and 7 antecedent conditions constituted 128 antecedent condition combinations. Since the combinations are only theoretically all possible solutions, we further determine which antecedent combinations are subsets of the results by evaluating the consistency of the combinations and the number of cases. According to Ragin [2], we set the original consistency score to 0.8 and the case frequency threshold to 1. PRI consistency threshold is set as 0.70 [19]. The combination consistency score above or equal to the critical value is indeed defined as fuzzy subset and coded as 1, while the combination below the critical value does not constitute fuzzy subset and coded as 0.

5.3. Antecedent Condition Necessity Test. A necessary condition is a condition that must exist to cause the result to occur. If the necessary condition does not exist in the configuration, the corresponding result will not happen, and other conditions cannot make up for the influence of the nonexistence of the necessary condition. However, the existence of necessary conditions does not guarantee the inevitable occurrence of the result. It still needs to be combined with other factors to produce a corresponding result. Before fuzzy qualitative comparative analysis, necessity analysis should be conducted on each antecedent variable. If the necessity is greater than 0.9, it is the core condition, indicating strong explanatory power for the result variable and should be taken into consideration in subsequent analysis. The necessity analysis of each antecedent condition is shown in Table 4. The necessity of each antecedent variable studied in this paper is less than 0.9, indicating that a single antecedent variable cannot explain the formation mechanism of each high-outcome variable. Therefore, fuzzy qualitative comparative analysis is needed to further explore its formation mechanism.

6. Configuration Result and Analysis

6.1. Configuration Result. Simplify the truth table and get the configuration of the outcome variable. For the study of high school students' continuance intention, no logical remainder is used, and the complex solution of the outcome variable is directly obtained. On this basis, the logical remainder is introduced to simplify the truth table, and the logical remainder is "IQ*CQ*SE*LE~PP" and "IQ*CQ*SE*LE*TI*PP" to obtain a simple solution. Then the logical remainders "~PP*TI*LE*SE*CQ*IQ" and "PP*TI*LE*SE*CQ*IQ" are added based on theory and practical knowledge to obtain intermediate solutions. For the study of nonsenior students' continuance intention, the logical remainder is not used, and the complex solution of the result variable is directly obtained. On this basis, the logic remainder is introduced to simplify the truth table, and the logic remainder is "~TI*~LE*~SE*~SQ*~CQ*~TP" to obtain a simple solution. Then the logical remainders "PP*~LE*SE~CQ*~IQ" and "PP*~LE*~SE*~SQ*~CQ*~IQ" is added based on theory and practical knowledge to obtain intermediate solutions. Through the comparison of the nested relationship between the intermediate solution and the reduced solution, the core condition of each solution is identified: the condition that appears in the intermediate solution and the reduced solution at the same time is the core condition of the solution, and the condition that only appears in the intermediate solution is the edge condition.

In this study, Fs-QCA3.0 software is used to process and analyze the data according to the above steps. After passing the necessity test, the consistency threshold is set as 0.8, PRI consistency threshold is set as 0.75, and case threshold is set as 1. Among them, there are 4 configurations with high continuance intention, and the consistency of each configuration is 0.902, 0.920, 0.908 and 0.900 respectively. The overall consistency reaches 0.901, and the overall coverage reaches 0.457 shown in Table 5.

This study follows the configuration representation method in Fiss et al. [20] and subsequent studies. ●and • indicate that the condition exists while ⊗ and ⊗ indicate that

TABLE 2: Descriptive statistical analysis results of research variables.

| Statistical indicator | Condition variable | | | | | | | Result variable |
| | Student level | | Platform level | | | School level | Parent level | |
	SE	LE	SQ	CQ	IQ	TI	PP	CI
Mean	3.101	3.491	3.552	3.277	2.891	3.602	3.854	3.012
Standard deviation	0.930	0.914	0.770	0.866	0.931	0.991	1.019	0.973
Minimum	1	1	1	1	1	1	1	1
Maximum	5	5	5	5	5	5	5	5

TABLE 3: Calibration anchor points for each variable.

| Research variable | | | Anchor point | | |
			Complete membership	Intersection	Complete nonmembership
Condition variable	Student level	SE	3.67	3	2.67
		LE	4	3.67	3
	Platform level	SQ	4	3.5	3
		CQ	4	3.33	3
		IQ	3.33	3	2.33
	Teacher level	TI	4.33	3.67	3
	Parent level	PP	5	4	3
Outcome variable		CI	3.67	3	2.33

TABLE 4: Necessity test of students' continuous learning intention.

	Condition variable	High continuance intention	Non-high continuance intention
Student level	SE	0.839	0.413
	∽SE	0.344	0.771
	LE	0.678	0.383
	∽LE	0.415	0.710
Platform level	SQ	0.692	0.431
	∽SQ	0.416	0.677
	CQ	0.658	0.314
	∽CQ	0.445	0.789
	IQ	0.743	0.432
	∽IQ	0.438	0.749
Teacher level	TI	0.470	0.511
	∽TI	0.598	0.557
Parent level	PP	0.532	0.562
	∽PP	0.593	0.563

TABLE 5: Configuration analysis of continuance intention.

| Condition variable | High and medium continuance intention | | | | Non-high continuance intention | | | | |
	S1a	S1b	S2	S3	H1a	H1b	H1c	H1d	H2
SE	●	●	●	•	⊗	⊗	⊗	⊗	⊗
LE		•	●	●	⊗	⊗	⊗	⊗	
CQ	●	●			⊗	⊗	⊗		●
SQ	●	●	●	●				⊗	⊗
IQ			●	●	⊗	⊗	⊗	⊗	⊗
TI	⊗	⊗	•	●	⊗	⊗	•	⊗	•
PP	⊗		⊗	●	⊗	⊗	•		●
Consistency	0.902	0.920	0.908	0.900	0.927	0.959	0.938	0.936	0.932
Coverage scale	0.269	0.268	0.228	0.184	0.256	0.228	0.223	0.122	0.247
Unique coverage	0.037	0.029	0.018	0.133	0.033	0.008	0.129	0.055	0.021
Overall consistency			0.901				0.924		
Overall coverage			0.457				0.504		

Note. ●and • indicate that condition exists, ⊗ and ⊗ indicate that condition does not exist; ● and ⊗ indicate core condition,• and ⊗ indicate edge condition.

the condition does not exist. ● And ⊗ indicate the core condition w ● and ⊗ indicate the edge condition. And "blank" indicates whether the condition exists or not in the configuration (there is no direct causal relationship with the result). The coverage in the table indicates the proportion of all samples that can be explained by this configuration. It should be noted that some samples can also be explained by other configurations. Net coverage indicates the proportion of the number of samples explained by a single configuration to the total number of samples. Therefore, net coverage is usually far less than the coverage, but it can more intuitively reflect the importance of a single configuration. As the research object of this study is individual, in order to facilitate analysis and discussion, Fs-QCA3.0 software is used to analyze the configurations leading to high and low continuance intention respectively. Different configurations represent different environmental ecology that achieves the same result (high or low continuance intention).

Qualitative comparison and analysis of fuzzy sets will get three types of solutions: complex solution (without logical residual term), reduced solution (including logical residual term, but without evaluating its rationality), and intermediate solution (only including the logical residual term consistent with theoretical and practical knowledge into the solution). An important advantage of intermediate solutions is that they do not allow the elimination of necessary conditions. In general, intermediate solutions are superior to the other two solutions. The core condition and edge condition of grouping states are distinguished according to the reduced solution and the intermediate solution. If an antecedent condition occurs in both the reduced solution and the intermediate solution, it is the core condition, which has an important influence on the results. If this condition only appears in the intermediate solution, it will be recorded as the edge condition, which is the condition of auxiliary contribution [1]. The middle solution is obtained through counterfactual analysis, that is, assuming that the presence of each condition variable (present) is likely to promote the continuance intention of middle school students, fuzzy set analysis shows that there are four configurations (paths) to produce the continuance intention of middle school students (as shown in Table 5). The consistency indexes of the four configurations are 0.902, 0.920, 0.908 and 0.900 respectively, indicating that the four configurations are sufficient conditions for the continuance intention of high school students. The overall consistency index is 0.901, which further indicates that the four configurations covering most cases are also sufficient conditions for the continuance intention of high school students. The overall coverage of the model is 0.497, indicating that the four configurations explain about 50% of the high persistence. At the same time, assuming that each condition variable (absent) may result in the high continuance intention, fuzzy set analysis shows that there are 5 configurations (paths) that produce high school students' non-high continuance intention, which covers the vast majority of cases, not only constitute the noncontinuous intention of sufficient condition, and explain about 50% of the causes of the high continuance intention.

6.2. High Persistence Path Analysis. In view of various core conditions involved in each group, in order to better compare the differences of different configurations, this paper summarizes the following four configurations (paths) that middle school students' continuance intention, shown in Table 5: Service quality and content quality of platforms and self-learning efficacy of middle school students are dominant; Service quality and content quality of platforms and self-learning efficacy of middle school students are dominant while learning engagement is auxiliary; Interaction between students and teachers and platforms is dominant while the service quality is auxiliary; Parents' participation, platform interaction and platform service quality are dominant while teachers' support is auxiliary.

(1) Service quality and content quality of platforms and self-learning efficacy of middle school students are dominant. S1a shows that middle school students with strong learning self-efficacy will continue to use online learning platforms as long as the content quality and service quality of online learning platform are high, no matter whether the platform has good interaction or not, whether parents participate in it or not and whether teachers support it or not. Specifically, when middle school students with high learning self-efficacy find the content and quality of online learning platform are good, they will continue to use it. In fact, if middle school students want to continue to use online learning platform, they will also be affected by the factors such as parental participation, teacher support and self-learning investment. When these factors are available, the continuance intention will be constantly strengthened, thus driving continuance intention behavior. This path can also be used to explain that middle school students with strong self-learning efficiency pay more attention to the content and services of platforms when they use online learning platforms, which is also the same reason that we usually see that students with strong ability knows how to study. These students have their own evaluation criteria when choosing online learning platforms. They can decide their own learning problems without asking parents or teachers. But this type of middle school students, in real life is rare. This paper verifies the positive effects of the platform content quality and service quality on middle school students' continuance intention, and also shows that the platform content quality, service quality and learning self-efficacy have synergistic effects on middle school students' continuance intention. The typical case of this configuration is Beijing No. 4 Online School. Since it was founded in 2001, the online learning platform with the purpose of "'let more children get better education," has constantly strengthened the platform content and at the same time set up more than 100 branch offices all over the country, which

can quickly provide online and offline integrated services for local online learning students.

It should be noted that this configuration also shows that when the content quality and service quality of online learning platforms promote the continuance intention of middle school students, the interaction of the platform has nothing to do with the high continuance intention of middle students. Specifically, when the content quality and service quality of platforms can meet the learning needs of middle school students, those with learning self-efficacy will choose the online learning platform for continuous learning. When they have puzzles, technical problems or other problems related to learning and life in other aspects, users of online learning platforms can solve problems in time through online and offline services. To some extent, this service replaces parents' participation and teachers' support. On the contrary, if the online learning platform can not provide timely and high-quality services, teacher support and parent participation may be more important.

(2) Service quality and content quality of platforms and self-learning efficacy of middle school students are dominant while learning engagement is auxiliary. S1b and S1a are basically the same. The two paths only differ in the learning input elements of middle school students. Learning input belongs to the edge core condition element in this path, which plays an auxiliary role. This is because, in a broad way, the two paths can be regarded as the same path, because the element of learning engagement only appears in the intermediate solution and reduced solution of the two paths. Therefore, in this paper, S1A and S1b are used to represent the two paths, and there is not too much explanation here. The author collectively refers to S1A and S1b as S1 path below. Through the above comprehensive analysis of configuration, S1 path is the type that service quality and content quality of platforms and middle school students' self-learning efficacy are dominant.

(3) Interaction between students and teachers and platforms is dominant while the service quality is auxiliary. S2 shows that the middle school students' continuance intention of online learning platforms not only requires strong learning self-efficacy, but also requires a lot of learning engagement. At the same time, middle school students prefer to interact with online teachers on the platform to obtain the learning support from online teachers. However, when middle school students study online, The length of time teachers spend online is limited. Specifically, online teachers leave the platform after online teaching, but the support students need to get exists for a long time, which leads to the contradiction that students and teachers cannot be online at the same time. Therefore, the service of the online learning platform is particularly important. This

service can resolve the contradiction that teachers and students can not communicate online at the same time, which is the reason why the service quality of platforms plays a major role in the S2 path. On the other hand, S2 path also shows that no matter what the content quality of online learning platforms is, whether parents participate or not, and whether school teachers give offline support, it will not affect the use of the online learning platforms by middle school students. This is because the participation of parents is mainly in the period of after-school education and students' independent learning. Parents only provide necessary material guarantee and supervision for students, while the offline support of school teachers is replaced by the online interaction with teachers in S2 configuration. And middle school students in this path devote more time to online learning. Therefore, they have more opportunities to communicate with online teachers, so as to solve some puzzles in learning.

In addition, students do not care about content quality of online platforms a lot, because the interaction of online learning platforms is strong, which allows students to more focus on the communication and exchange with online teachers, thus solving the learning problems in class. At the same time, if the problems are not solved in class, students can always turn to the service department provided by the platform for help at any time. Therefore, parental involvement and content quality of the platform have no impact on the continuance intention of their online learning platform. This paper verifies the positive effects of platform interaction and platform service quality on students' continuance intention of online learning platforms, and also shows that there is synergistic effect of platform interaction, platform service quality and online learning investment on students' continuance intention. The typical case of this configuration is Intelligent Practice System Online School. This online learning platform, with live teaching method is given priority to, emphasizes more on the digestion of knowledge in class, so more attention is paid to the interaction. This will allow students to ask questions at any time, and get on-site solution. At the same time, the platform also provides a large number of platform customer service, which can answer and solve students' difficulties in time, providing a powerful aid to online learning.

(4) Parents' participation, platform interaction and platform service quality are dominant while teachers' support is auxiliary. The S3 path shows that even when middle school students are more engaged in learning, their continuance intention is also affected by both parental involvement and teacher support, which is particularly important in this path. To be specific, although such students have more engagement in online learning, their learning self-efficacy is not prominent, so they need more

participation of parents in online learning, and parents play a role of companionship, supervision and encouragement in the whole process. These middle school students have correct learning attitude and average ability, and they need more interaction and offline communication with teachers in online learning to complete their learning tasks. They are also more dependent on the services provided by the platform and always want help in the first place when they encounter problems.

It is worth noting that the S3 path also shows that the quality of platform content has nothing to do with the middle school students' continuance intention of online learning platforms. As long as online interaction and parental supervision are well created, and teachers can support and help offline, middle school students' continuance intention of online learning platforms will be affected. To be specific, if online learning can be interactive in a timely manner, teachers can provide strong support offline, and service departments of platforms can be supplemented in time, these factors can synergistically affect the middle school students' continuance intention of online learning platform. Therefore, the content quality of online learning platform is not so important. On the other hand, if the platform is not interactive enough, parents cannot participate in it and teachers do not support it, no matter how high the content quality of platforms is, it will not motivate middle school students to continue to use the online learning platform. The typical case of this configuration is New Oriental Online School, which has launched a dual-teacher class—there are two classroom situations in one course—Teachers of New Oriental Headquarters use online learning platform as the main teacher; students of the same grade and subject are required to study in the same classroom, where auxiliary teachers are equipped to maintain classroom discipline. If students have any questions in the learning process, first of all, the auxiliary teacher can make records and sort them out. After sorting them out, the teacher can use the network to transfer them to the lecturer, who can then answer the students' questions. Auxiliary teachers in dual-teacher classes play both the role of platform service and parental participation.

By comparing the three configuration paths (S1a and S1b have been mentioned in the above analysis: S1a and S1b can be regarded as one path S1), according to the coverage index, the coverage of S1 and S2 reaches about 77%, which explains 77% of the outcome variable and covers about 230 cases. On the whole, a majority of middle school students have the willingness of high continuance intention through S1 and S2 paths. This fully shows that online learning platforms should not only have good interaction, high-quality platform content and high-quality services, but also adopt the integration of online and offline development and school teachers' support, so as to have a deep and powerful influence on the middle school students' continuance intention. By comparing the three configurations, it is also found that S3 path is different from SI and S2. S3 path requires more roles to participate at the same time, especially teachers

and parents, with relatively high requirements. For most families, the time for parents to accompany their children to study is also "relatively" limited. Especially at the middle school stage, children's learning time is long and the number of subjects is large, which makes it difficult for parents to meet their children's requirements. Whether teachers can support students' online learning depends on the specific situation. Most online learning is carried out after class. Whether teachers have enough practical support for students after class needs more discussion. The low coverage and interpretation rate of S3 paths is also the reason.

7. Conclusion

The research analyzes the configuration of middle school students' continuance intention from the student level, parent level, teacher level and platform level. Based on the configuration analysis model, by comparing the configuration analysis data and the configuration path of middle school students' willingness of continuance intention, the user retention mechanism of online learning platform under the collaborative influence of multi-level elements is finally identified and summarized.

The main conclusions are as follows:

(1) Through data analysis, this paper finds that a single element at each level does not constitute a necessary condition for the middle school students' continuance intention.

The data analysis structure shows that the necessary condition analysis results of each antecedent variable studied in this paper do not exceed 0.9, indicating that a single antecedent variable cannot explain the formation mechanism of high outcome variables. The necessary condition is the one that must exist to cause the result. If the necessary condition does not exist in the configuration, the corresponding result will not occur, and other conditions cannot make up for the impact of the absence of necessary conditions. However, even if the existence of the necessary conditions does not guarantee the inevitable occurrence of the results, it still needs to be combined with other factors to produce the corresponding results. Therefore, this paper takes four levels and multiple elements as antecedent variables for configuration analysis.

(2) This paper adopts the configuration perspective and Fs-QCA method to analyze the configuration of 7 factors from 4 levels of students, parents, teachers and platforms respectively, and obtains 3 configurations.

① Service quality and content quality of platforms and self-learning efficacy of middle school students are dominant

② Service quality and content quality of platforms and self-learning efficacy of middle school students are dominant while learning engagement is auxiliary

③ Parents' participation, platform interaction and platform service quality are dominant while teachers' support is auxiliary

(3) Based on the configuration analysis model, three kinds of student user retention mechanisms of online learning platforms are finally identified and summarized by comparing the configuration analysis data table in this paper.

① Middle school student user retention mechanism based on online learning platforms dominated by platform quality.
This user retention mechanism is suitable for middle school students with strong self-learning efficiency and independent learning ability, so the online platform only needs to consider the content quality and service quality of the platform.

② Middle school student user retention mechanism based on online learning platforms dominated by platform interaction.
The user retention mechanism is suitable for middle school students who have strong self-learning efficiency and are willing to devote more time and energy to online learning. Therefore, the online learning platform only needs to consider the interactivity of the platform and take the service quality into account.

③ Middle school student user retention mechanism based on online learning platforms dominated by "Parent-teacher" dual drive, platform interaction and service quality.

The user retention mechanism is suitable for middle school students with weak self-learning efficiency but correct learning attitude and willing to devote themselves to learning. These middle school students attach great importance to the platform's interactivity, service quality and parents' participation, and are also concerned about whether school teachers support them.

Data Availability

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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