

# The Comprehensive Quality Model and Evaluation System of Secondary School Students

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**Abstract:** *This study builds a comprehensive quality model and corresponding evaluation indicators for secondary school students. Based on the theoretical of the iceberg, this study has initially established a comprehensive quality model and corresponding evaluation system, after three rounds of experts (n=12) and pre-testing samples (n=277) questionnaires investigation, the result shown that the comprehensive quality model has a good reliability ( $\alpha > 0.8$ ) and validity ( $KMO > 0.8$ ,  $p < 0.005$ ), the model evaluation system can be divided into two public factor. Among the two public factors, knowledge ability, social role, values, self-cognition, characteristics, and motivation as a factor indicator and skills ability as another public factor indicator. Research value: This study provides a quantitative evaluation model and related evaluation indicators for the comprehensive quality of secondary school students. It has feasible practical evaluation value for the development level of the comprehensive physical and mental quality of secondary school students.*

**Keywords:** Comprehensive Quality, Secondary School students, Iceberg Model

## 1. Introduction

Education is an important tool for the development of every country, and it is the process by which society consciously passes on its cultural heritage, knowledge, values, and skills from generation to generation (Lateef & Malik, 2021). School education quality focuses on the various relationships among investment, process, and output to promote students' quality of education (Garira, 2020). High quality includes good ideological and moral qualities, scientific culture, material quality, and psychological quality (Liu, 2010). Comprehensive quality is the entirety of individual knowledge, intelligence, technical ability, and psychological quality, and the approach of education is to provide each learner with knowledge of professionalism, excellence, motivation, and learner satisfaction (Nazareth et al., 2020). Improving the comprehensive quality of educated groups is a common educational concept worldwide. Comprehensive quality is an important factor in promoting the civilized quality of social groups and the level of social technological progress; it is also an important demand for the country's high-level talent pool (Tang, 2022).

The United Nations has set out 17 Sustainable Development Goals to change the world, of which Goal 4 is education, titled "Ensure inclusive and high-quality education for all and promote lifelong learning" (Saini et al., 2023). China's educational concept has gradually shifted from "examination-oriented" education to quality education, and the national educational philosophy and basic education practice have gradually developed in the direction

of quality education (Zhou, 2013). In 1993, China promulgated the “Outline of China's Education Reform and Development”, which clearly stated that primary and secondary education should change from “examination-oriented education to the direction of improving the national quality, and comprehensively improve students' ideological and moral, cultural science, labor skills and physical and mental health”, fostering all-round development of talents (Li et al., 2023). The concept of people-oriented quality education has become a new curriculum reform direction, and quality education in primary and secondary schools has shown a good development trend (Papanthymou & Darra, 2023; Haleem et al., 2022).

General education courses and extracurricular programs can help students reflect on their purpose and develop the characteristics necessary for leadership and responsible citizenship. The comprehensive quality of theoretical research focuses on professional skills in China, such as teachers' teaching abilities and doctors' technical and personal professional skills (Hu et al., 2020). However, there are few comprehensive evaluation reports on the physiological and psychological aspects of secondary-school students. Chen et al. (2023) optimize the traditional comprehensive quality evaluation model, selected five dimensions of ideological and moral, academic, physical, extended learning, and practice to evaluate the comprehensive quality of secondary school student. The self-assessment mechanism of primary and secondary education quality includes multi-subject participation, comprehensive quality assessment, comprehensive method application, and focus on quality, which includes observation methods supplemented by interviews and discussion methods (Zhang & Zhong, 2023).

Secondary school students have experienced increased academic pressure, especially the reform of the Chinese high school entrance examination system. Academic achievement, family income, and marital status of students and their parents were significantly associated with stress, anxiety, and depression in secondary school students (Al-Shehri et al., 2022). Secondary school students with unhealthy lifestyles and dietary habits have led to a low level of health; the longer time spent watching television (TV) and internet ate network are the main factors affecting their sleep time, and inadequate sleep, depression, and smoking were the leading unhealthy behaviors among the respondents (Qidwai et al., 2010). Secondary school students show a range of psychological disorders such as anxiety, depression, and reduced self-efficacy in their academic and daily lives (Chang et al., 2018). Social support, study atmosphere, grade, study pressure, and the district area where the school is located, with the factors of family economy, father's education level, family structure, and parents' bad habits, all have a strong impact on the lifestyle of secondary school students (Li & Qiu, 2018). However, there are currently no reports on the comprehensive quality of secondary-school students. Referring to the previous discussion about the goal of this research, based on the problem statements, the main question in this research is concerned with the effects of these factors on firm performance:

Q1. What are the elements of comprehensive quality for secondary school students based on iceberg theory?

Q2. What is the comprehensive quality value for secondary school students?

In the following sections, we introduce the research process and then use data analysis to evaluate the internal association and future research direction of the research model.

## 2. Literature Review

### 2.1 Comprehensive Quality

The core quality of a nation determines its competitiveness and international status. Quality can be defined in terms of perfection, excellence, value for money, fitness to purpose, or transformation (Harvey, 2005). Since the 1990s, “core competencies” have become an important topic in global education policies, practices, and research. International organizations, many countries, and regions have successively constructed a framework for students' core competencies, increasing international development aid through Education for All (2000), Millennium Development Goals (2000), Sustainable Development Goals (2015), and other global campaigns promising to provide high-quality and equitable education for more children worldwide (Sahlberg, 2023).

In 2016, the Chinese Ministry of Education proposed a new framework for the development of core competencies for Chinese students in the new century, with comprehensive development as the core; cultural foundation, autonomous development, and social participation as the three fields; and humanistic connotation, scientific spirit, learning to learn, healthy life, responsibility, and practical innovation as the six literacy directions, putting forward new performance requirements for students' qualities (Wang, 2019). The new trend of key competences-based education is the localization of key competencies in China, which introduces the personal, cultural, and social dimensions into the list of competences, paying considerable attention to the well-being of the children; hence, it is a great step toward educating the wholeness of the person (Zhao, 2020) (Figure1).

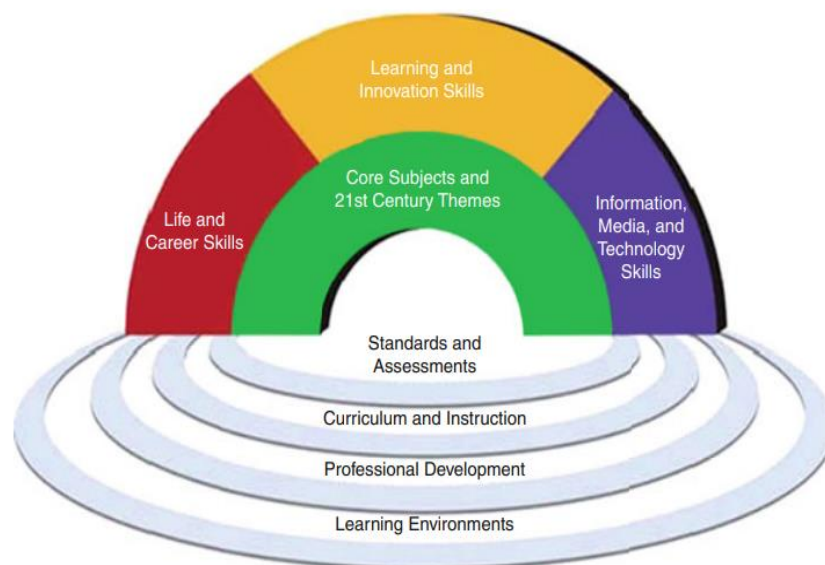


**Figure 1: Core Quality Development of Chinese Students**

Source: Zhao (2020)

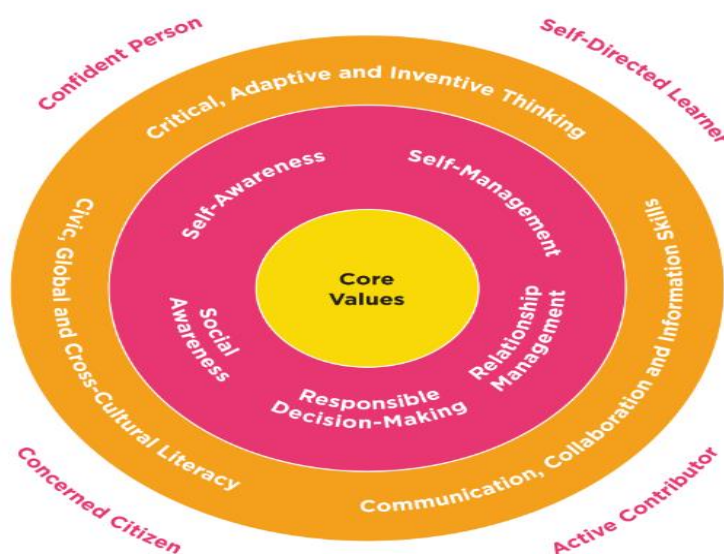
The core competency framework elements in the United States are specifically manifested in two directions: external learning objectives and internal implementation. The external learning objectives include three parts of learning and innovation skills, life and vocational skill, information, media and technical skills; the internal implementation include standard and evaluation, curriculum and teaching, teacher profession development and learning environment (OECD/CERI, 2008; Wan & Gut, 2011; Subkhan & Widhanarto, 2017)(Figure 2).

Some important 21st century competencies by Partnership for 21st century competencies are categorized into three types: life and career skills; learning and innovation skills; and information, media, and technology skills (Subkhan & Widhanarto, 2017). The core values of Singapore's “ 21st century literacy ” framework include three levels of literacy: self-cognition, self-management social consciousness, interpersonal relationship management and decision of the responsible, intermediate literacy being information and cooperation communication, critical and innovative thinking, citizen literacy, global awareness, and cultural exchange skills; external literacy includes people who are confident, those who can actively learn, those who actively contribute, and citizens who care about their country (Tan et al., 2017)(Figure 3).



**Figure Error! No text of specified style in document.: The Framework of “21st World Literacy” in the United States**

Source: OECD/CERI (2008);Wan & Gut (2011); Subkhan & Widhanarto (2017)



**Figure 2: Singapore' “21st Century Literacy” Framework**

Source: Tan et al. (2017)



The South Korean curriculum calls for an Exam-Free Semester during which middle school students explore career opportunities and develop self-directed learning abilities involving cooperative projects, discussion, and project-based learning, and the integration of cross-subject themes throughout the curriculum, including safety/health education, character education, education for democratic citizenship, and career education (Russell, 2016).

Based on various lists of competencies from different countries' reports, De-Se-Co identified three broad categories: using tools interactively, interacting in heterogeneous groups, and acting autonomously (Salas-Pilco, 2013). China mainly focuses on cultivating students' learning enthusiasm and knowledge, skills, and friendships, while South Korea increasingly emphasizes the importance of developing students' meta-cognition and mastering self-directed skills (Sun, 2022).

Comprehensive quality refers to a comprehensive ability in a person's knowledge level, moral cultivation, adaptability, survival, and social ability (Galvan et al., 2020). The comprehensive evaluation system of student quality should include comprehensive quality theoretical models of independent development, social participation, and cultural foundation, to be effective in the long run, and improvements in education need to enable all students to have access to quality education early, to stay in the system until at least the end of upper secondary education, and to obtain the skills and knowledge needed for effective social and labor market integration (OECD, 2012).

## 2.2 Iceberg Model

The iceberg model is applied to the evaluation of individual competency literacy in human resource management, the iceberg model for competencies takes the help of an iceberg to explain the concept of competency (Hassane et al., 2022). The iceberg model is a famous model proposed by American psychologist McClellan in 1973, based on the iceberg model, in which the different manifestations of individual qualities of personnel are divided into the surface “above the iceberg” and the deep “below the iceberg” (Chen et al., 2021). Explicit qualities above the iceberg, including knowledge and skills. It is an external performance that is easy to understand and measure, and easier to change and develop through training. Implicit quality below the iceberg includes social roles, values, self-cognition, characteristics, and motivation, which are intrinsically difficult to measure. It is not easily changed through external influences, but it plays a key role in the behaviour and performance of people (Luo, 2018) (Figure 4)



**Figure 3: Iceberg Model**  
Source: Luo (2018)

The iceberg model is a common model for assessing competency, according to Spencer and Spencer, the most important characteristic of a competency was its ability to predict future job performance or behaviour in a specific criterion or standard, which includes five parts: knowledge, skills, self-concept, traits, and motivation (Chung & Wu, 2011). Knowledge and skills are the visible part of the iceberg above the water, whereas motivation and traits are the hidden part of the iceberg underwater. Self-concept lies between these two sets of factors, and can be changed by education, psychology, and accumulated experience in the long term (Michibayashi et al., 2020). Competence potential encompasses the individual characteristics needed for the realization of certain outcomes, which include dispositional potential (traits, motives, values) and other accomplishments (knowledge, skills, qualifications, and experience) (Škrinjarić, 2022). The research of KSAO (knowledge, skills, ability, others) dimensions provides a reliable basis for the value and scientific argumentation of the iceberg model (Maurer et al., 2003).

Since the iceberg model was first proposed, it has been used in the field of human resource management. It is regarded as an important tool for evaluating and selecting employees, helping organizations to better understand the overall qualities of employees. The application of the iceberg model is not limited to the field of human resources but is also used in education, psychology, organizational behavior, and other fields. Liu (2023) research believes that it is necessary to establish a comprehensive quality evaluation model for students in vocational colleges to promote the development of students' comprehensive quality. In the rule of law talent competency model, explicit qualities mainly include two elements, professional literacy and multidisciplinary literacy, which include five elements: developmental ability, personality traits, interpersonal coordination ability, social ethics, and professional identity (Niu, 2022). Zhao and Zhang (2016) found that the implicit qualities of MBA professional abilities include ideological and moral qualities and physical and mental qualities; explicit abilities originate from knowledge and skills, interpersonal communication and experience cognition. The relative contribution of implicit qualities was greater than that of explicit qualities. The competency of confidential personnel in petrochemical enterprises includes seven aspects: knowledge, skills, role positioning, values, self-image, personality and motivation (Wu, 2024). According to the iceberg model, the comprehensive quality of secondary school students is divided into explicit qualities (knowledge and skills) and explicit qualities (social roles, values, self-cognition, characteristics, and motivation). A questionnaire and practice evaluation method for secondary school students' comprehensive quality was constructed using literature and expert interview methods. The research process used badminton education as an auxiliary influencing factor, while the experimental group received four weeks of badminton education, and the control group did not receive special physical education. The study conducted a survey and collection of comprehensive quality indicators and experimental data on the experimental group and the control group to analyze the differences in comprehensive quality between the experimental and control groups. This was used to measure the impact of badminton education on the comprehensive quality of secondary-school students.

### **3. Badminton Education Research Design and Method**

The study design included the following three steps (Figure 5).

- 1) Collect the elements of comprehensive quality, materials, and viewpoints related to secondary school students, and screen indicators that effectively reflect comprehensive quality (Table 1).

- 2) Investigations and research on relevant experts and coaches. After three rounds of experts' Delphi suggestions (n=12), a comprehensive quality model of secondary school students was initially built.
- 3) Pre-testing Sample Group. To test the reliability and validity of the comprehensive quality model, 300 secondary school students from different schools were randomly selected as verification samples.

### 3.1 Step 1--Literature Review

This study collected the contents of comprehensive quality on secondary school students by using the literature and primarily constructed a comprehensive quality model, which includes seven contents: ability, skill ability, social role, value, self-cognition, characteristics, and motivation (Table 1).

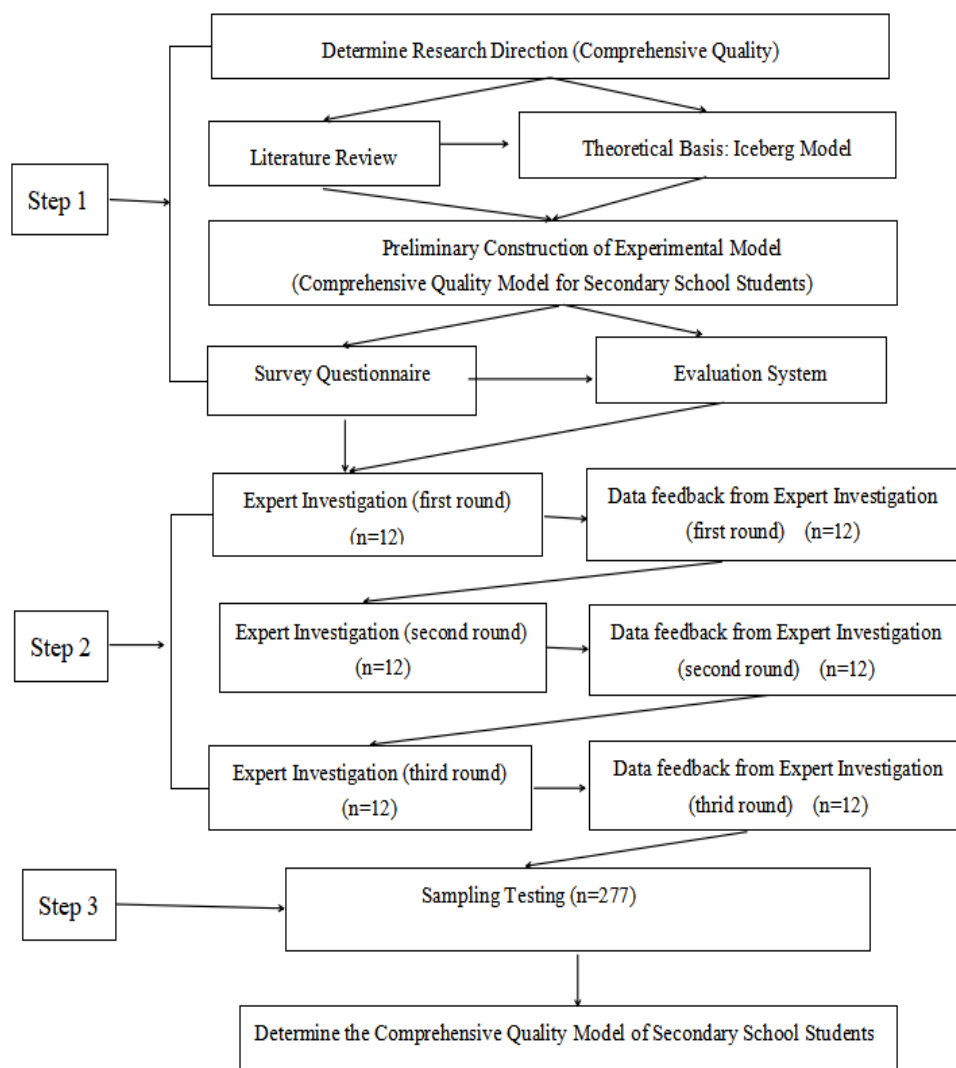


Figure 5: Research Design (Model Construction and Experiment Process)

Table 1: The contents of comprehensive quality model

Construct	Items	Source
Knowledge Ability	Discipline knowledge Social Knowledge Life Knowledge Attitude of Knowledge	Wang et al. (2019); Feng (2019); Su et al. (2018).

Skill Ability	Physiological Quality	Das (2018); Sanjay (2022); Kirthika et al. (2019); Raya et al. (2013)
Social Role	Personal Value Orientation Relationship Orientation Social Identity Orientation Group Identity Orientation	Briggs & Cheek (1986); Cheek et al. (1994)
Value	Ultimate Values Tool Values	Rokeach (1969); Zhong et al (2021); Jin et al (2008).
Self-cognition	Physiological Self-cognition Psychological Self-cognition Social Self-cognition	Jiang (2007); Meng et al (2013); Mao (2005); Xu (2013)
Characteristic	Neuroticism; Extroversion Openness; Agreeableness Conscientiousness	Judge et al. (2002); Soto (2018)
Motivation	Motivation for Success Motivation to avoid Failure	Smith (2015); Kankaras (2017)

### 3.2 Step 2-- Questionnaire by experts and Pre-test Sample by secondary school students

The process of using the Delphi technique to obtain consensus in the comprehensive quality of secondary school students' research: Delphi is an expert method that has been accepted by many writers to obtain consensus among experts (Loo, 2002). The Delphi technique allows researchers to obtain highly reliable data from certified experts using strategically designed surveys (Hallowell and Gambatese, 2010). To prove the accuracy of the content items of the comprehensive quality and relations questionnaire, this study used the Delphi technique to obtain a consensus on concept comprehensive quality. The actual size of a Delphi panel is not limited, but the literature often recommends that the panel should have at least 10–15 members (Gordon, 2022). In the literature, the number of panelists is mostly between 15 and 30 (Lil et al. 2011). Philip Bruiak (2022) said the number of experts to be 13. To guarantee a reliable result, an expert panel should consist of 3–9 members as a minimum of three to nine members (Li et al., 2011). This study invited 12 education experts (6 college sports teachers, 3 secondary school teachers, and 3 badminton coaches) as participants. Twelve experts who had been as teachers in college or middle school for more than 10 years and had free time to attend the investigation process of this study. The questionnaires were emailed to all 12 experts with an official letter of invitation and a feedback form. The process of the Delphi technique includes three rounds and uses consensus data of the experts' feedback, which was performed based on the median, interquartile range, and quartile deviation in all three rounds to evaluate the importance of the statements.

**Delphi Round One:** The Delphi process traditionally begins with an open-ended questionnaire. The open-ended questionnaire serves as the cornerstone of soliciting specific information about a content area from Delphi subjects (Greenway & School, 1999). Based on the literature review and experts' interview of responses, the structured questionnaire is both an acceptable and a common modification of the Delphi process format in round one. The study then summarizes the common point of view about secondary school students' comprehensive quality, which includes 21 items and relations with 52 questionnaires. The research provided a guideline for the expert panel regarding the scores to be given, and the total scores were 100%. In the first round, the Delphi panels were provided with closed-ended, 5-point Likert scale questions to elicit their level of agreement with a series of statements regarding the relative importance of



concept comprehensive quality developed by the researcher. In round one, after receiving participants' responses, the research needs to convert the collected information into a well-structured questionnaire. Participants were asked to rate the categorized responses from Round one on a scale of 1 to 5, with 1= very irrelevant, 2= not relevant, 3= less relevant, 4= relevant, and 5= very relevant. The questionnaire was used as the survey instrument for the second round of data collection. This study used SPSS version 23 for descriptive statistics. A consensus on the topic can be decided if a certain percentage of the votes falls within a prescribed range (Latif et al., 2017).

The major statistics used in Delphi studies are measures of central tendency (mean, median, and mode) and level of dispersion (standard deviation and inter-quartile range) to present information concerning the collective judgement of respondents (Hasson et al., 2000). The group response median value and inter-quartile range distribution were used as references for the degree of importance and consensus in past research (Siraj & Ali, 2008). Based on the median, interquartile range, and quartile deviation, the analysis of consensus data of the experts was performed on Round one, two and three data. The subsequent analysis technique classified items according to the consensus level and importance level using SPSS version 23.0.

**Delphi Round Two:** In Round Two, consensus begins to form, and the actual outcomes can be presented among the participants' responses (Jacobs, 1996). After two weeks of experts' responses from round one, the research collects and provides feedback on the results of round one to the experts. In round two, the questions were modified based on the experts' comments. The results for Round 1 also indicated that most experts gave scores between four and five. To understand more easily the valuable responses of the questionnaire were changed from portrait to landscape layout by experts, round two adds the result of min and median that was obtained from the response round one (Latif et al., 2017). At the same time, each Delphi participant received a second questionnaire and was asked to review the items summarized by the investigator based on the information provided in the first round. As a result of round two, areas of disagreement and agreement were identified.

**Delphi Round Three:** Two weeks were given to the panel members to respond to round one, two and three. In round three, all participants were asked to revise their judgement in order to reach a consensus based on the results of round two. Simultaneously, participants were asked to review their responses, respond again using the same rating scale, and add any comments regarding the responses. All comments of the items have been cited in the text, and some others are presented in the Delphi technique Round three. The survey was successful in providing general consensus regarding the comprehensive quality of the concept of secondary school students. The third round aimed to achieve consensus and narrow the range of differences in opinion among experts. The data were analyzed, the median and interquartile range were calculated, and findings from the Delphi third round were used to answer the research question. Consensus was justified after each Delphi round before interpreting the results. The analysis of consensus data of the experts was performed based on the median, interquartile range, and quartile deviation on round one, two and three data. After the median value, interquartile range, and quartile deviations were identified, the subsequent analysis technique classified items according to the consensus level and importance level. The consensus level is divided into three levels (high, medium, and no consensus), and the importance level is divided into two levels (very high and low). The consensus level was determined as high if quartile deviation is less than or equal to 0.5, medium if quartile deviation is in between 0.5 and 1, no consensus if quartile deviation is more than 1. The importance level is very high if the median value is 4 or above, and low if the median value is less than 3.5.

In this process of the Delphi technique, this study used three rounds to validate and conceptualize the comprehensive quality of 21 items and 48 relation questionnaires. The researcher used the formula from Norizan Abdul Razak (2003) as a guideline to obtain the consensus and importance of items (see Tables 2 and 3). The value of the inter-quartile range using the formula (Q3-Q1) was determined using Microsoft SPSS version 23.0 and reported in the round three questionnaire. The data from round three were treated in a similar manner. The formula for identifying Quartile deviation (QD) is as follows:

$$\text{Formula: } QD = \frac{\text{Inter - quarter range}}{2} \\ = \frac{(Q3 - Q1)}{2}$$

**Formula 1: The Formula for identifying deviation (QD) Source: Latif et al (2017)**

**Table 2: Level of consensus and importance**

Quartile deviation (QD)	Level of consensus	Items Median	Median
Less or equal to 0.5 ( $QD \leq 0.5$ )	High	4 and above ( $M \geq 4$ )	High
More than 0.5 and less than or equal to 1.0 ( $0.5 < QD \leq 1.0$ )	Moderate	3.5 and less ( $M \leq 3.5$ )	Low
More than 1.0 ( $QD > 1.0$ )	Low and no consensus	—	—

Note: Formula by Norizan (2003) on classifications of consensus was determined at three levels

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Level	Description
High importance — high consensus	Items that achieved high consensus with QD value of less or equal to 0.5, but are regarded as important and very important with median of 4 and above [ $(QD \leq 0.5)$ and $(M \geq 4)$ ]
High importance — moderate consensus	Items that achieved moderate consensus with QD value of more than 0.5 and less of equal to 1.0, but are regarded as important and very important with median 4 and above [ $(0.5 < QD \leq 1.0)$ and $(M \geq 4)$ ]
High importance — no consensus	Items that did not achieve consensus with QD value of more than 1.0, but are regarded as important and very important with median 4 and above [ $(QD > 1.0)$ and $(M \geq 4)$ ]
Low importance — high consensus	Items that achieved high consensus with QD value of less or equal to 0.5, but are regarded as moderate and not important with median of 3.5 and less [ $(QD \leq 0.5)$ and $(M \leq 3.5)$ ]
Low importance — moderate consensus	Items that achieved moderate consensus with QD value of more than 0.5 and less of equal to 1.0, but are regarded as moderate and not important with median of 3.5 and less [ $(QD > 0.5)$ and $(M \leq 3.5)$ ]
Low importance — no consensus	Items that did not achieve consensus with QD value of more than 1.0, but are regarded as moderate and not important with median 3.5 and less [ $(QD > 1.0)$ and $(M \leq 3.5)$ ]

Source: Adapted from Norizan (2003)

### 3.3 Step 3-- Questionnaire Survey and Model Inspection Sample (Pre-testing sample)

In order to make sure this comprehensive quality model is suitable for the badminton education of secondary school students, this study chose 300 secondary school students as a pre-testing sample. This comprehensive quality model was tested using an investigation question (Table 4).

**Table 4: The pre-testing sample (n=300)**

School	First grade (n)	Second grade (n)	Third grade (n)	Total(n)
LuoYang No.3	33	34	33	100
XinYang No.2	33	33	34	100
PingYu No.3	34	33	33	100

According to social theory, the pre-testing sample number is more than 5 times the number of the questionnaires, so this study used 300 students as the pre-testing sample, including 100 students in the first grade of secondary school, 100 students in the second grade and 100 students in the third grade. The pre-testing samples in this research were chosen from not Third Middle School of Luoyang City, Henan Province; the No. 2 Middle School of Xinyang City, Henan Province, and the Third Middle School of Pingyu City, Henan Province (Table 4). After questionnaire, a total of 277 questionnaires are effective, the efficiency of the questionnaire is 92.33%. The questionnaire uses 5-point Likert scale questions. The pre-testing sample responded using a 5-point scale based on their initial subjective consciousness. The 5-point Likert scale consists of the below points? The scale: 1 = Strongly Disagree; 2 = Disagree; 3 = Neither Agree nor Disagree; 4 = Agree; 5 = Strongly Agree. The results of the questionnaire were analyzed by SPSS version 23. Regarding using the alpha as the reliability measure of comprehensive could you please provide more context or clarify your question? evaluation indicator.

#### 4. Statistical Methods

Knowledge ability, social role, values, self-cognition, characteristics, and motivation are forms of qualitative research in the comprehensive quality model. Therefore, the 5-point Likert scale is adopted in the questionnaire survey and statistics. The questionnaire set five different options as 1-strongly disagreed, 2-disagree, 3-uncertain, 4-agree, and 5-strongly agree. Each option is assigned a score of 1, 2, 3, 4, or 5 in the investigator of comprehension quality model. The skill capacity component table is also divided into 5 levels, which adopt a quantitative detection method, refer to the physical health standards of secondary school students, and assign the corresponding achievements. The comprehensive quality of secondary school students is calculated based on the weights of the secondary indicators. The results can also be evaluated based on the comprehensive quality level of the research team and the quality level of each dimension.

#### 5. Analytical method

This study mainly used Excel and 23.0 statistical software to conduct statistical analysis of and analyze the survey questionnaire, determine the reliability and effectiveness of the research, the research trend reflected by the questionnaire data.

#### 6. Result and Analyze

##### 6.1 The reliability and validity of the comprehensive quality model by the experts' investigation

**Table 5: Delphi Technique (Round 1 and 2) (n=12)**

Item	Round 1			Round 2		
	Median	Mean	QD	Median	Mean	QD
Knowledge Ability	4.0	4.3	0.5	4.0	4.4	0.5
Skill Ability	4.0	4.2	0.5	4.5	4.5	0.5

Social Role	4.5	4.3	0.5	4.5	4.4	0.5
Value	4.0	3.8	0.4	4.0	4.1	0.4
Self-cognition	4.0	4.1	0.9	4.0	4.4	0.5
Characteristic	3.5	3.5	0.5	4.0	4.1	0.4
Motivation	4.0	4.3	0.5	4.0	4.4	0.5

**Table 6: Delphi Technique (Round 3) (n=12)**

Item	Median	Mean	QD
Knowledge Ability	5.0	4.7	0.5
Skill Ability	5.0	4.7	0.5
Social Role	5.0	4.6	0.5
Value	4.0	4.4	0.5
Self-cognition	5.0	4.6	0.5
Characteristic	4.0	4.3	0.5
Motivation	5.0	4.7	0.5

Tables 5 and 6 show that after three rounds of the Delphi technique and the experts' responses, the Quartile Deviation (QD) of the seven statements was 0. = 0.5) which indicates that the level of consensus was high, so all expert panels' responses lay in the scale of 5 (very relevant) in this study. The median scores were more than 4 in the third round of the Delphi technique, which means the level of importance of the statements was high according to all experts' views. Then, the seven statements of the comprehensive quality questionnaire had a good reliability, with twelve expert panels showing overall agreement.

## 6.2 The validity of the comprehensive quality model by the pre-testing sample

**Table 7: The reliability of survey questionnaire on pre-testing sample investigation (n=277)**

Contents	Items(n)	Cronbach's Alpha	Reliability	p
Overall survey questionnaire	48	0.859	$\alpha > 0.8$	0.000
Knowledge Ability	8	0.865	$\alpha > 0.8$	0.000
Social Role	8	0.736	$\alpha > 0.7$	0.000
Value	8	0.686	$\alpha > 0.6$	0.000
Self-cognition	6	0.641	$\alpha > 0.6$	0.000
Characteristic	10	0.767	$\alpha > 0.7$	0.000
Motivation	8	0.740	$\alpha > 0.7$	0.000

**Table 8: The survey questionnaire on Pre-testing sample investigation (n=277)**

Cronbach's Alpha	Reliability	KMO	p
0.859	$\alpha = 0.859 (\alpha > 0.8)$	0.851	0.000

Tables 7 and 8 show that the reliability of the comprehensive quality model on the pre-testing samples for investigation questions is  $\alpha = 0.859 (\alpha > 0.8)$ , the validity of the comprehensive quality model is  $KMO = 0.851 (KMO > 0.8)$  Bartlett's test,  $p = 0.000$  (Table7). The results mean that this model has high reliability and validity, and this comprehensive quality model is good for evaluating the research value. It can be considered that this survey questionnaire has high research value for the comprehensive quality of secondary school students.

## 6.3 The validity of the comprehensive quality model by the Pre-testing sample

As Table 9 shows, the main component analysis method is used to extract 2 public factors based on standards of more than 1. Table 8 shows that the characteristic value of initial eigenvalues on the public factor 1 is 3.659, and the characteristic value of the initial eigenvalues

on the public factor 2 is 1.024. The two public factors express 66.900% contribution rate by cumulating the entire information on the model, which has a high degree of information expression. It is believed that the main component analysis effect is ideal and has research significance.

As Table 10 shows, the first public factor of this model contains knowledge ability, social role, value, self-cognition, characteristics, and motivation; the second public factor contains skill ability.

**Table 9: The viability of the comprehensive quality by pre-testing sample (n=277)**

Items	Initial Eigenvalues (total)	Initial Eigenvalues (Cumulative %)	Rotation Sums of Squared Loadings (% of Variance)	Rotation Sums of Squared Loadings (Cumulative %)
Knowledge ability	3.659	52.267	52.170	52.170
Skill ability	1.024	66.900	14.729	66.900
Social role	0.898	79.728		
Value	0.412	85.607		
Self-cognition	0.389	91.166		
Characteristic	0.318	95.703		
Motivation	0.301	100.00		

**Table 10: The total rotated component Matrix<sup>a</sup> by Pre-testing sample (n=277)**

Items	Component 1	Component 2
Knowledge ability	0.806	0.174
Skill ability	0.073	0.892
Social role	0.818	0.196
Value	0.820	0.112
Self-cognition	0.827	0.058
Characteristic	0.716	-0.219
Motivation	0.676	-0.320



**Figure 6: The Scree Plot of Survey questionnaire on Comprehensive Quality Model**

The scree plot of the model in Figure 6 shows that the higher the point, the greater the potential energy and high research significance. The critical point displayed between the steep slopes and slow slopes shows that the feature values of factor 1 and factor 2 are greater than 1, while the characteristic values of other factors are below 1, so the construction of a comprehensive quality model can be extracted using 2 public factors.



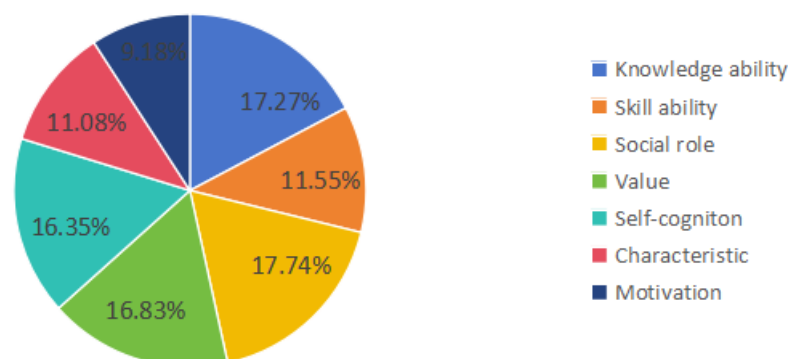
#### 6.4 The weighting factor of the comprehensive quality model

The process of calculating the index weighting factor involves the linear combination coefficient and comprehensive score coefficient. The linear combination coefficient formula is: loading matrix / sqrt(eigen), the load coefficient is divided by a square root with a corresponding characteristic root. The comprehensive score coefficient calculation formula is: Cumulative (linear combination coefficient \* square variance interpretation rate) / accumulation variance interpretation rate. From Table 10 and Figure 7, it can be seen that the comprehensive quality of the model includes 2 components. Component 1 includes knowledge ability, social role, value self-cognition, characteristics, and motivation, while Component 2 contains skill ability. The weighting factor of component 1 is  $0.780 * \sqrt{40560170/66}$ . The weighting factor of component 0.780, and the weighting factor of component 2 is  $0.220 * \sqrt{14729/66}$ . Equals 0.220) The weight distribution of Table 8 and Figure 7 show that the knowledge (w1=0.1727), social role (w3=0.1774), values: (w4=0.1683) and (w5=0.1635) have higher weights and the skill (w2=0.1155: \ (w6=0\). 1108) and (w7=0). 0918) Have lower weights; motivation is the weight of the lowest.

**Table 10: The weight coefficient of comprehensive quality model by Pre-testing sample (n=277)**

Items	Linear combination coefficient factor 1	Linear combination coefficient factor 2	Comprehensive score coefficient	Weight coefficient
Knowledge ability	0.4256	0.1314	0.3608	0.1727
Skill ability	0.0617	0.8776	0.2413	0.1155
Social role	0.4324	0.1522	0.3707	0.1774
Value	0.4313	0.0692	0.3516	0.1683
Self-cognition	0.4334	0.0158	0.3415	0.1635
Characteristic	0.3680	-0.2520	0.2315	0.1108
Motivation	0.3445	-0.3488	0.1919	0.0918

**The Weight Coefficient of Comprehensive Quality Model**



**Figure 7: The weight coefficient of comprehensive quality model**

## 7. Conclusion

By using literature information collection, experts, and a pre-texting sample investigation questionnaire, this study found that the comprehensive quality model of the iceberg model theory has high research value for the comprehensive quality of secondary school students. At the same time, this study verified the overall effect of the comprehensive quality model and relevant evaluation indicators from both explicit and implicit views. The reliability and validity showed a high value in the research.

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