Chinese teenager physical health campus organizing cultivation fuzzy comprehensive evaluation

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ABSTRACT

Chinese teenager physique is backbone of Chinese future, only improve teenager physique then can promote civil overall quality, the paper makes fuzzy comprehensive evaluation on Chinese teenager physical health, firstly analyzes main factors: social factor, education factor, management factor and others three aspects factors, and evaluates from campus fitness facilities, school sports staff cultivation, sports course organizing cultivation, and others four aspects. By comprehensive evaluation value, it can get 0.39 that is larger than other each evaluation value, therefore, presently Chinese teenager physical health evaluation is normal that to be further improved and developed.

KEYWORDS

Teenager; Physical health; Fuzzy comprehensive evaluation; Fitness facilities; School physical education.
INTRODUCTION

With the development of global competition, teenager education becomes key factor. However, teenagers that immerse in learning, their physique become main issue, with multiplying of such phenomenon, their health status is even worse. Presently, Chinese teenagers physical status don’t adapt to teenagers’ education, the influence range is expanding by year, Chinese teenagers’ physique is facing extremely challenge.

**TABLE 1**: Teenager physique influential main factors

<table>
<thead>
<tr>
<th>Social factor</th>
<th>Education factor</th>
<th>Management factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economy</td>
<td>Sports teachers’ level</td>
<td>Physical education management organization</td>
</tr>
<tr>
<td>Living way</td>
<td>Leaders attention, school physical education safety</td>
<td>Physical education regulations ad system</td>
</tr>
<tr>
<td>Family education</td>
<td>School physical education management, sports activities organizing</td>
<td>Physical education health systems</td>
</tr>
<tr>
<td>Policy of Only child</td>
<td>Test-oriented education, school sound education</td>
<td>Physical education standards implementation</td>
</tr>
</tbody>
</table>

By TABLE 1, it shows teenager physique influential main factors are social factor, education factor, management factor, and get relative details that belong to each type of factors in these three types of factors, as economic aspect, management aspect and so on. It can also show that to improve teenager physique, it can start from above aspects to analyze and improve.

**TABLE 2**: Year 2009 and 2012 Wuhan city shortsighted rate growth

<table>
<thead>
<tr>
<th></th>
<th>Average rate of shortsighted %</th>
<th>Year 2009 Wuhan city shortsighted rate %</th>
<th>Year 2012 Wuhan city shortsighted rate %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary school</td>
<td>51.17</td>
<td>50.28</td>
<td>54.78</td>
</tr>
<tr>
<td>Junior high school</td>
<td>79.23</td>
<td>75.36</td>
<td>81.65</td>
</tr>
<tr>
<td>Senior high school</td>
<td>83.75</td>
<td>80.45</td>
<td>92.31</td>
</tr>
</tbody>
</table>

In TABLE 2, it compares and gets year 2009 and 2012 two years’ Wuhan city shortsighted rate growth, and with studies increasing, average rate of shortsighted are obviously increasing. From pupil average rate of shortsighted as 51.17%, now teenager shortsighted rate is universal since primary school, the problem is very serious.

**TABLE 3**: Obesity rate

<table>
<thead>
<tr>
<th></th>
<th>Overweight rate</th>
<th>Obesity rate</th>
<th>Year 2010 Hubei province overweight rate</th>
<th>Year 2010 Hubei province obesity rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban schoolgirl</td>
<td>12.15</td>
<td>1023</td>
<td>12.56</td>
<td>6.97</td>
</tr>
<tr>
<td>Urban schoolboy</td>
<td>20.16</td>
<td>18.65</td>
<td>20.36</td>
<td>17.14</td>
</tr>
<tr>
<td>Rural schoolgirl</td>
<td>11.34</td>
<td>7.62</td>
<td>11.86</td>
<td>7.45</td>
</tr>
<tr>
<td>Rural schoolboy</td>
<td>15.13</td>
<td>15.36</td>
<td>15.36</td>
<td>14.26</td>
</tr>
</tbody>
</table>

By TABLE 3, it can indicate that schoolboy obesity rate is larger than schoolgirl, and rural teenager obesity rate is lower than urban teenager, so proper physical exercises are very important to Chinese modern teenager.

**FUZZY EVALUATION MODEL ESTABLISHMENTS**

Fuzzy comprehensive evaluation model

Fuzzy comprehensive evaluation model fits for fuzzy computation that multiple factors are uncertain, the paper utilizes fuzzy comprehensive evaluation, and steps are as following:
At first, the paper establishes factor set $U$:

$$U = \{U_1, U_2, \ldots, U_k\}$$

Secondly, establish judgment set $V$ (evaluation set), the paper establishes evaluation matrix fuzzy mapping from $U$ to $V$, obtained fuzzy relation as following matrix show:

$$R = \begin{bmatrix}
  r_{11} & r_{12} & \cdots & r_{1n} \\
  r_{21} & r_{22} & \cdots & r_{2n} \\
  \vdots & \vdots & \ddots & \vdots \\
  r_{m1} & r_{m2} & \cdots & r_{mn}
\end{bmatrix}$$

The paper establishes weight set, $A = (a_1, a_2, \ldots, a_n)$, it meets conditions:

$$\sum_{i=1}^{n} a_i = 1 \quad a_i \geq 0$$

Fuzzy relation $R$ every line will reflect the line influence factors to object judgment degree, meanwhile, $R$ every column will reflect the column influence factors to object judgment degree.

$$\sum_{i=1}^{n} r_{ij} = 1, j = 1, 2, 3, \ldots, m$$

Secondly the paper carries on following computation according to fuzzy comprehensive evaluation:

$$B = A \cdot R$$

$$= \begin{bmatrix}
  a_1 & a_2 & \cdots & a_n
\end{bmatrix} \cdot \begin{bmatrix}
  r_{11} & r_{12} & \cdots & r_{1n} \\
  r_{21} & r_{22} & \cdots & r_{2n} \\
  \vdots & \vdots & \ddots & \vdots \\
  r_{m1} & r_{m2} & \cdots & r_{mn}
\end{bmatrix}$$

$$= \begin{bmatrix}
  b_1 & b_2 & \cdots & b_n
\end{bmatrix}$$

In $V$, fuzzy combination is evaluation set $B$. To sum up, actually fuzzy comprehensive evaluation obtained multimode system simple change model is as Figure 1 shows:

\[ \begin{array}{c}
\text{A} \\
\text{R} \\
\text{B-VIA-AX}
\end{array} \]

**Figure 1 : Simple change model**

According to Figure 1 marked contents, it gets fuzzy comprehensive evaluation change model, and can establish corresponding every factor grade evaluation transformation function, evaluation
factors $u_1, u_2, u_3, u_4, u_5$ membership functions can be expressed as following formula (1), (2), (3) shows:

$$
u_1(u_i) = \begin{cases} 
0.5(1 - \frac{u_i - k_1}{u_i - k_2}), & u_i \geq k_1 \\
0.5(1 - \frac{k_1 - u_i}{k_1 - k_2}), & k_2 \leq u_i < k_1 \\
0, & u_i < k_2 
\end{cases} \quad (1)$$

$$\nu_2(u_i) = \begin{cases} 
0.5(1 - \frac{u_i - k_1}{u_i - k_2}), & u_i \geq k_1 \\
0.5(1 + \frac{k_1 - u_i}{k_1 - k_2}), & k_2 \leq u_i < k_1 \\
0.5(1 - \frac{u_i - k_2}{k_2 - k_3}), & k_3 \leq u_i < k_2 \\
0.5(1 - \frac{k_3 - u_i}{k_3 - u_i}), & u_i < k_3 
\end{cases} \quad (2)$$

$$\nu_3(u_i) = \begin{cases} 
0, & u_i \geq k_2 \\
0.5(1 - \frac{k_2 - u_i}{k_2 - k_3}), & k_3 \leq u_i < k_2 \\
0.5(1 + \frac{k_3 - u_i}{k_3 - k_1}), & u_i < k_3 
\end{cases} \quad (3)$$

Combine with Fuzzy evaluation model to evaluate

By above model principle established factor set $U$, among them $U = (U_1, U_2, U_3, U_4)$. Among them, campus fitness facilities $U_1$, school sports staff cultivation $U_2$, sports course organizing cultivation $U_3$, others $U_4$, it gets TABLE 4. The paper establishes small factors sets in four important factor sets.

**TABLE 4 : Chinese teenager physique evaluation indicator system**

<table>
<thead>
<tr>
<th>Campus fitness facilities $U_1$</th>
<th>school sports staff cultivation $U_2$</th>
<th>sports course organizing cultivation $U_3$</th>
<th>Others $U_4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campus facilities introduction $U_{11}$</td>
<td>Coaches cultivation $U_{21}$</td>
<td>Sports competition $U_{31}$</td>
<td>Sports observation and emulation $U_{41}$</td>
</tr>
<tr>
<td>Campus facilities maintenance $U_{12}$</td>
<td>Teaching and administrative staff cultivation $U_{22}$</td>
<td>Extracurricular activities $U_{32}$</td>
<td>Physical education development $U_{42}$</td>
</tr>
<tr>
<td>Competition facilities construction $U_{13}$</td>
<td>Competition introduction $U_{23}$</td>
<td>Physical education course lecturing $U_{33}$</td>
<td>Traditional sports revitalization $U_{43}$</td>
</tr>
<tr>
<td>Daily facilities construction $U_{14}$</td>
<td>Sports staff cultivation expense $U_{24}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apparatus changing $U_{15}$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
By TABLE 4 listed factors, it gets evaluation set.

\[ U_1 = \{u_{11}, u_{12}, u_{13}, u_{14}\} \]

\[ U_2 = \{u_{21}, u_{22}, u_{23}, u_{24}, u_{25}\} \]

\[ U_3 = \{u_{31}, u_{32}, u_{33}\} \]

\[ U_4 = \{u_{41}, u_{42}, u_{43}, u_{44}\} \]

By collecting data and analyzing, it gets four factors importance degree ranking statistics as TABLE 5 shows.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Rank 1</th>
<th>Rank 2</th>
<th>Rank 3</th>
<th>Rank 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campus fitness facilities ( U_1 )</td>
<td>23</td>
<td>7</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>School sports staff cultivation ( U_2 )</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>Sports course organizing cultivation ( U_3 )</td>
<td>0</td>
<td>9</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Others ( U_4 )</td>
<td>3</td>
<td>21</td>
<td>9</td>
<td>0</td>
</tr>
</tbody>
</table>

By TABLE 5 sorting, it gets campus fitness facilities \( U_1 \), school sports staff cultivation \( U_2 \), sports course organizing cultivation \( U_3 \), others \( U_4 \) four aspects ranking matrixes.

\[ U_2 = \{23, 7, 4, 0\} \]

\[ U_3 = \{7, 18, 8, 0\} \]

\[ U_3 = \{0, 9, 13, 12\} \]

\[ U_4 = \{3, 0, 9, 21\} \]

Obtained weighted vector from rank 1 to rank 2:

\[ \beta = \{\beta_1, \beta_2, \beta_3, \beta_4\} = \{0.4, 0.3, 0.2, 0.1\} \]

\[ U_1^* = U_1 \cdot \beta^T \]

\[ U_1^* = 14, \ U_2^* = 9.4, \ U_3^* = 4, \ U_4^* = 5.6 \]

The paper takes normalization processing:

\[ U_1^* = 0.35, \ U_2^* = 0.3, \ U_3^* = 0.2, \ U_4^* = 0.15 \]
It gets:

\[ A = (0.35 \ 0.3 \ 0.2 \ 0.15) \]

The paper establishes remarks membership, as TABLE 6 show.

**TABLE 6 : Remarks membership**

<table>
<thead>
<tr>
<th>Evaluation way</th>
<th>Set scores interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-60</td>
</tr>
<tr>
<td>Very good</td>
<td>0.00</td>
</tr>
<tr>
<td>Good</td>
<td>0.00</td>
</tr>
<tr>
<td>Normal</td>
<td>0.05</td>
</tr>
<tr>
<td>Bad</td>
<td>0.95</td>
</tr>
</tbody>
</table>

The paper through Chinese teenager physical cultivation obtained evaluation in campus fitness facilities \( U_1 \), school sports staff cultivation \( U_2 \), sports course organizing cultivation \( U_3 \), others \( U_4 \) four aspects each indicator, it gets TABLE 7.

**TABLE 7 : Chinese teenager physique each indicator obtained evaluation value**

<table>
<thead>
<tr>
<th>Each layer indicator</th>
<th>Evaluation value</th>
<th>Each layer indicator</th>
<th>Evaluation value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campus facilities introduction</td>
<td>Normal</td>
<td>Sports competition</td>
<td>Good</td>
</tr>
<tr>
<td>( U_{11} )</td>
<td></td>
<td>( U_{31} )</td>
<td></td>
</tr>
<tr>
<td>Campus facilities maintenance</td>
<td>Normal</td>
<td>Extracurricular activities</td>
<td>Good</td>
</tr>
<tr>
<td>( U_{12} )</td>
<td></td>
<td>( U_{22} )</td>
<td></td>
</tr>
<tr>
<td>Competition facilities</td>
<td>Normal</td>
<td>Physical education course</td>
<td>Good</td>
</tr>
<tr>
<td>Construction ( U_{13} )</td>
<td></td>
<td>lecturing ( U_{33} )</td>
<td></td>
</tr>
<tr>
<td>Daily facilities construction</td>
<td>Normal</td>
<td>Games ( U_{34} )</td>
<td>Normal</td>
</tr>
<tr>
<td>( U_{14} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apparatus changing ( U_{15} )</td>
<td>Normal</td>
<td>Sports observation and emulation</td>
<td>Bad</td>
</tr>
<tr>
<td>Coaches cultivation ( U_{21} )</td>
<td>Very good</td>
<td>Physical education development</td>
<td>Normal</td>
</tr>
<tr>
<td>Teaching and administrative</td>
<td>Very good</td>
<td>Traditional sports revitalization</td>
<td>Normal</td>
</tr>
<tr>
<td>staff cultivation ( U_{22} )</td>
<td></td>
<td>( U_{43} )</td>
<td></td>
</tr>
<tr>
<td>Competition introduction ( U_{23} )</td>
<td>Bad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sports staff cultivation</td>
<td>Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>expense ( U_{54} )</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

By above model, it gets single layer indicator weight factor fuzzy set is:

\[ U_1^+ = \{U_{11}, U_{12}, U_{13}, U_{14}, U_{15}\} = \{0.25 \ 0.25 \ 0.2 \ 0.15 \ 0.15\} \]

\[ U_2^+ = \{U_{21}, U_{22}, U_{23}, U_{24}\} = \{0.54 \ 0.1 \ 0.24 \ 0.14\} \]

\[ U_3^+ = \{U_{31}, U_{32}, U_{33}, U_{34}\} = \{0.4 \ 0.3 \ 0.1 \ 0.2\} \]

\[ U_4^+ = \{U_{41}, U_{42}, U_{43}\} = \{0.3 \ 0.4 \ 0.3\} \]
By TABLE 5, and combine with TABLE 3 remarks membership, the paper gets campus fitness facilities $U_1$, school sports staff cultivation $U_2$, sports course organizing cultivation $U_3$, others $U_4$ each aspect evaluation set:

$$
U_1 = \begin{pmatrix}
0 & 0.05 & 0.95 & 0.05 \\
0 & 0.05 & 0.95 & 0.05 \\
0 & 0.05 & 0.95 & 0 \\
0 & 0.05 & 0.95 & 0
\end{pmatrix}
$$

$$
U_2 = \begin{pmatrix}
0.05 & 0.90 & 0.05 & 0 \\
0.05 & 0.90 & 0.05 & 0 \\
0.9 & 0.05 & 0.95 & 0 \\
0 & 0.05 & 0.95 & 0.05
\end{pmatrix}
$$

$$
U_3 = \begin{pmatrix}
0.05 & 0.95 & 0.05 & 0 \\
0 & 0.05 & 0.9 & 0.05 \\
0 & 0.05 & 0.9 & 0.05 \\
0.05 & 0.9 & 0.05 & 0
\end{pmatrix}
$$

$$
U_4 = \begin{pmatrix}
0.05 & 0.95 & 0.05 & 0 \\
0.05 & 0.95 & 0.05 & 0 \\
0.05 & 0.95 & 0.05 & 0
\end{pmatrix}
$$

Carry on following computation on above evaluation set:

$$
B_i = A_i \cdot R_i
$$

Make normalization processing with obtained $B_i$, it gets fuzzy evaluation matrix.

$$
B = \begin{pmatrix}
B_1 \\
B_2 \\
B_3 \\
B_4
\end{pmatrix} = \begin{pmatrix}
0.07 & 0.26 & 0.13 & 0.42 \\
0 & 0.15 & 0.76 & 0.54 \\
0.14 & 0.24 & 0.21 & 0.17 \\
0.14 & 0.2 & 0.3 & 0.36
\end{pmatrix}
$$

It gets comprehensive evaluation value:

$$
Z = U^* \cdot B = (0.16 \ 0.24 \ 0.39 \ 0.21)
$$

**CONCLUSION**

In view of the whole world, the generation of teenager’s physical health level, especially for physical ability declination trend is not only just existing in China, but also many countries come across similar status. Especially entering into 50s of the 20th century, teenager physical health level declination problem has gradually become world developed countries joint confronted difficulties, how to strengthen teenager children physical health accordingly becomes world subject. Chinese teenager physical health status recent ten years’ accelerated sliding tendency also shows violating phenomenon with Chinese economic development trend, which also should be focused.
By comprehensive evaluation, it can get 0.39 that is larger than other each evaluation value, therefore, presently Chinese teenager physical health evaluation is normal that to be further improved and developed.

REFERENCES


