Evaluation scales for athletes’ psychological competitive ability: development and systematization of the scales

Mikio Tokunaga

スポーツ選手に対する心理的競技能力の
評価尺度の開発とシステム化

徳永幹雄

要約

スポーツ選手の心理的競技能力を診断する方法を開発する目的から、1983年以米、種々のスポーツ選手を対象に調査を行った。約15年間に5,334名のスポーツ選手に調査した。その後、スポーツ選手の諸特性との関係を統計的に分析するために、心理的競技能力の因子、下位尺度及び総合得点を算出し、妥当性や信頼性を検証した。その主な結果は、つきのとおりである。

1. スポーツ選手の心理的「特性」としての心理的競技能力を診断する方法として52（嘘尺度4項目を含む）の質問項目から構成され、12尺度及び5因子に分類される調査法である「心理的競技能力診断検査（DIPCA.2）」を開発した。

2. スポーツ選手の心理的「状態」として心理的競技能力を診断する方法として次の2つの方法を開発した。

1）スポーツ選手の試合前の心理状態を診断する方法として20（嘘尺度2項目を含む）の質問項目で構成され、9尺度及び5因子に分類される調査法である「試合前の心理状態診断検査（DIPSB.1）」を開発した。

2）スポーツ選手の試合中の心理状態を診断する方法として10の質問項目から構成される調査法である「試合中の心理状態診断法（DIPS-D.2）」を開発した。

3. スポーツ選手の心理面の指導のために3つの診断検査のシステム化を試みた。

キーワード：スポーツ選手、心理的競技能力、評価尺度、システム化

Key Words: athlete, psychological competitive ability, evaluation scale, systematization

Introduction

The gap between the ability that athletes make full use of one's ability in practice and in competitions is greatly attributable to psychological factors, and said to have been caused by differences in "mental strength". However, this term is somewhat abstract and may have a variety of meanings depending on who uses it. Due to the increasing importance attributed to this quality some clarification as to what it refers to may be necessary. In our study "psychological competitive ability" refers to those traits which enable an athlete to compete at his/her best. We have addressed the psychological competitive ability athletes must possess and those traits that must be brought into play prior to and during competition, and how such psychological competitive ability should be evaluated and developed in a training program.

The development of the required psychological competitive ability is called "Psychological Skills Training (PST)" in the United States, and the work of Griffith (1930) is believed to be its origin (Murphy and Tammen, 1998). Thereafter a number of theories and methods for evaluation and training were proposed. Among them, Athletic Motivation Inventory (AMI) by Tutko, Lyon and Ogilvie (1969) is regarded as a pioneering work in psychological skill evaluation. The subsequent representative methods for evaluation are Psychological Performance Inventory (PPI) by Loehr (1986), the Psychological Skill Inventory for Sport (PSIS) by Mahoney, Gabriel and Perkins (1987), the Sport-Related Psychological Skills Questionnaire (SPSQ) by Nerson and Hardy (1990), and the Golf Performance Survey (GPS) by Thomas and Over (1994). The evaluation methods developed recently place importance on athletes' stress-coping skills, as exemplified by the Athletic Coping Skills Inventory-28 (ACSI-28) by Smith, Sehutz, Smoll, and Ptacek (1995).

In Japan, although the importance of psychological fortitude for athletes had long been recognized, the study of sport psychology developed with a focus on the athlete's personality. There has been a tendency to discuss personality characteristics based on trait theory by using psychological tests developed in psychology. These tests include the Yatabe-Guilford Personality Test (Y-G), Minnesota Multiphasic Personality Inventory (MMP), Uchida-Kraepelin Mental Work Aptitude Test, Trait-State Anxiety Inventory (TAI & SAI), and Tokyo University-version Egogram (TEG) and are given to athletes who have recorded distinguished results in order to analyze the personality traits of successful athletes.

Relatively recently, in Japan, the concept of psychological skills has become better known with the introduction of the Sport Competition Anxiety Test (SCAT), Competitive State Anxiety Inventory (CSAI-2), Taikyo Sport Motivation Inventory (TSMI), Profile of Mood States (POMS), Psychological Conditioning Inventory (PCI) as well as the aforementioned PPI, PSIS and other tests.

In Japan, however, there was no method particularly designed to evaluate an athlete's psychological ability required in a competitive setting and, instead, methods originally developed for other fields of psychology have been applied to athletes. Whereas, the perspective worth attention in the studies of the U.S. has been to define the athletes' psychological ability as psychological skills. Under these circumstances, since around 1983 we have independently carried out research on methods both for diagnosing and coaching to improve athletes' psychological competitive ability.
The purposes of this study are to present an overview of our past study results, to verify the validity and reliability of three diagnostic tests described below, and to provide systematized psychological competitive ability evaluation scales by analyzing the relationships between these tests and various traits of athletes as well as the correlation between the three tests.

To systematize means in this paper to formulate the three tests into an evaluation scale designed for goal achievement by analyzing the correlation between the three tests and the achieved goal levels. It also means to formulate into an evaluation scale with consideration given to the time of applying the three tests and contents for guidance.

The first test is a method to identify the psychological competitive ability commonly required of athletes in a competitive setting. The second is a method to diagnose the psychological state during a period from one day to roughly one month prior to competition and to provide desirable conditioning guidance. The third is a test used immediately after competition to easily determine the psychological state during competition.

Methods

1. The survey periods and subjects

The survey was conducted on 5,334 athletes over nearly 15 years from 1986 to 1999. The subjects consisted mainly of National Athletic Meet participants from Fukuoka Prefecture, students of national physical-education universities, national universities and the physical education department of private universities, members of competing teams in regional finals of the Japan High-school Baseball Championships, and male members of the All-Japan Judo Association special training.

2. Survey items

The questionnaire to find general psychological traits necessary for athletes in a competitive setting had 68 items in the first phase of study (1986), 48 items in the second phase (1989) and 52 (including 4 lie scale items) in the third phase (1990). Respondents were asked to select one of five options by Likert’s method in response to each question. For instance, the answers to “Can you perform patiently even in difficult situations?” ranged from “I always can” to “I hardly can.”

For surveying the psychological condition prior to competition, 20 items considered necessary for athletes before competition were checked. For each question, five level options by Likert’s method were provided from which respondents might choose. For instance, the answers to “Are you prepared to bear even hard practice?” ranged from “absolutely” to “not at all”.

To determine the psychological condition during competition, 10 issues considered to be necessary for the athletes during competition were investigated. Respondents were asked to select one of five options by Likert’s method in response to each question. For instance, the responses to “I was able to exercise endurance” ranged from “absolutely” to “not at all”. In addition, several traits including self-evaluated mental strength, the degree of making full use of one’s ability, competition results and length of experience were also investigated.

3. Analysis procedures

The responses to each question item were converted into scores to examine the reliability and validity of the tests in accordance with the test preparation procedures. For conversion into scores, points were given to the 5 answers depending on their desirability. This ranged from 1 for the least desirable to 5 for the most desirable.

Thereafter, we sought the factors, sub-scales
and total scores for psychological competitive ability to statistically analyze their relationships with various traits of athletes and examine the validity of the tests.

Results and Discussion

1. Evaluation scale of psychological competitive ability as "traits"
   1) Preparation of Diagnostic Inventory

   The first phase of this study was conducted, by naming the "mental strength" required of athletes in a competitive setting "psychological competitive ability" and clarifying the concrete contents of the ability, to develop a method to diagnose it. To collect possible question items, we first asked roughly 400 university students in the physical education department and other departments to freely describe "what abilities are required for mental strength in sports". Combining the results from this survey and relevant items selected from the prior studies in Japan and overseas, we prepared a questionnaire consisting of 68 questions. Then, a survey was conducted on the Fukuoka Prefecture participants in the 1986 National Athletic Meet and obtained 236 responses. The response data was subjected to statistical analysis of reliability coefficient, item analysis and factor analysis. The reliability coefficient found by using Spearman-Brown's formula was very high, \( r = 0.935 \). Three items were deleted after item analysis (by chi-square test of the two groups divided by good-poor analysis as well as Pearson's correlation coefficient between the total score and the score for each question). Furthermore, 17 items were found to be inappropriate and deleted after factor analysis (principal factor solution, varimax rotation). Thus, the remaining 48 items are determined as question items of discriminant validity (Tokunaga and Hashimoto, 1988).

   In the second phase of the study, a questionnaire was prepared with some additions and amendments to the 48 questions scrutinized in the first phase, and responses were collected from 526 university students. Item analysis (the same analysis method as in the first phase) revealed discriminant validity in all questions. For reliability, high reliability coefficients were obtained as 0.947 by Spearman-Brown's formula of the split-half method and 0.946 by Guttman's method. In order to analyze the factor variability, factor analysis (principal factor solution, varimax rotation) was conducted and five factors were extracted. Although slight changes in factors were noted as compared with the result in the first phase, we concluded that no fundamental amendment was necessary regarding the respective factors and the sub-scales as well as those questions of which they were constituted. Then, the factors and sub-scales were categorized as shown in Table 1 (Tokunaga et al., 1991; Tokunaga, 1991). The sub-scales consist of the factors sought by further factor analysis for each of the five factors, which we conducted because they respectively comprise many question items and are presumed to be dividable into several items. Murakami confirmed in year 2000 that the five fac-

<table>
<thead>
<tr>
<th>Factors and sub-scale to determine the psychological traits for athletes</th>
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<tbody>
<tr>
<td><strong>Factors</strong></td>
</tr>
<tr>
<td>2. Mental stability and concentration</td>
</tr>
<tr>
<td>3. Confidence</td>
</tr>
<tr>
<td>4. Strategic ability</td>
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<tr>
<td>5. Cooperation</td>
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</table>

Tokunaga
tors have very high reliability coefficients (Cronbach's alpha) for showing internal consistency: \( a = 0.76 \) for factor 1, \( a = 0.88 \) for factor 2, \( a = 0.88 \) for factor 3, \( a = 0.87 \) for factor 4 and \( a = 0.91 \) for factor 5.

Through the above procedures, five principal factors with 12 scales were identified as the items to determine the psychological traits of athletes. They are volition for competition (patience, aggressiveness, volition for self-realization, volition for winning), mental stability & concentration (self-control, ability to relax, concentration), confidence (confidence, decisiveness), strategic ability (predictive ability, judgment) and cooperation (See Fig. 1). Although there is some duplication, most of the above items have commonality with those indicated by Japanese researchers and American researchers in particular. In the United States, this ability is considered to be a psychological skill that can be improved and developed through training.

For example, Murphy and Tammen (1988) reported that the skill items often indicated by six distinguished researchers were concentration / attention, confidence, imagery / mental practice, motivation / commitment, anxiety control, relaxation, preparation / goal setting, attitude / thought control, and emotional control. However, the item of cooperation has not been found in overseas studies, and seems to be a requirement particular to Japanese athletes.

After following the procedures referred to above and giving proper form to the questionnaire to identify athletes’ general psychological traits, the “Diagnostic Inventory of Psychological Competitive Abilities for Athletes (DIPCA.1)” was completed (Tokunaga et al., 1991a). This Inventory has 52 items consisting of 48 questions and 4 lie scale items. The 48 questions can be classified into 5 factors with 12 scales. Thereafter the inventory was developed into “DIPCA.2” with evaluation method added (Tokunaga 1994, 1995, 1999c).

2) The relationships between psychological competitive ability and various traits

The DIPCA was used to compare the relationships between psychological competitive ability and various traits of many athletes. First the relationship with self-evaluated mental strength was checked. To the question “How do you evaluate your own mental strength?” the athletes chose an answer from five selections ranging from “very high” to “none” and were divided into groups according to the answer. Then the relationships of the DIPCA scores with each group were investigated by one-way analysis of variance. Significant differences were noted for all of the five factors and 12 scales, indicating the higher the self-evaluated mental strength, the higher the DIPCA scores (Tokunaga et al., 1991; Tokunaga, 1991).

Next, to examine the relationships of the DIPCA scores with outstanding athletes, the group with three times or more experiences of participating in national championships or other national-level competitions was compared with the group with less experience in such competitions by analy-
sis of variance. The former group presented significantly higher scores for the factors of volition for competition (patience, aggressiveness, volition for self-realization, volition for winning), mental stability & concentration (self-control, concentration), confidence (confidence, decisiveness) and strategic ability (predictive ability, judgment) (Tokunaga et al., 1991; Tokunaga, 1991). When the scores were compared according to the number of participation experiences in National Athletic Meets, those with a greater number of experiences showed superiority in the factors of mental stability & concentration, confidence and strategic ability as well as the scales of patience and aggressiveness (Tokunaga, 1996). The senior members, invited members, junior members, high school members and junior high school members designated by the All Japan Judo Federation for special training were also compared. The senior members had the highest mean total score, and the total scores declined as the level approached the junior high school members (Tokunaga et al., 1995). Comparison of the champion team and the second place team decided in the finals of the Japan High school Baseball Championships showed the champion team was superior in mental stability & concentration and cooperation (Tokunaga, 1991). Furutani and Yaguchi (1993) reported on soft-tennis student players that groups with higher competition results and players with longer competitive experience had higher scores. In addition, Miyata (1997) reported that prizewinners in National Athletic Meets scored high points, and Fukuoka Prefecture Sports Promotion Bureau (1997) reported that the athletes designated by Fukuoka Prefecture for special training marked higher than general athletes.

For the relationships with the length of experience, those with 10 or more years of experience were superior in the factors of mental stability & concentration, confidence and strategic ability as well as in patience and aggressiveness (Tokunaga and Hashimoto, 1988).

Next, the subjects were divided into groups by the degree of making full use of one's ability as self-evaluated by choosing from 5-level selections to compare them by analysis of variance. Significant differences were noted in all of the five factors and 12 scales, showing the higher the self-evaluation, the higher the scores (Tokunaga and Hashimoto, 1988; Tokunaga et al., 1991; 1999). In examination of the relationships with the competition results, significant differences were indicated in patience, aggressiveness and concentration among three groups of men, the 1st to 6th place, the 7th to 16th place, and the 17th and lower places in the National Athletic Meet results (Tokunaga and Hashimoto, 1988). However, comparison between 5 groups of the 1st place, the 2nd place, the 3rd and 4th places, the 5th to 8th places, and the 9th and lower places indicated no significant relationship of the competition results with any of the five factors (Tokunaga et al., 1999).

Comparison between the sexes using the recent data in particular (Tokunaga et al., 2000a) is shown in Table 2. Males had a significantly higher mean total score than females. When compared by factors, males had significantly higher mean scores for strategic ability, confidence and mental stability & concentration. Comparison by scales also indicated significantly higher mean scores in males than in females for judgment, confidence, predictive ability, decisiveness, aggressiveness and self-control. However, females scored significantly higher than men in volition for self-realization, and tended to be slightly higher in cooperation. For volition for winning and concentration, there was no remarkable difference between the sexes. The finding of higher total scores for males is consistent with other investigations. However, it has been reported that no significant differences were found between the sexes for self-control, concen-
Table 2  Comparison between the sexes of psychological competitive abilities

<table>
<thead>
<tr>
<th>Scale and factor</th>
<th>Male</th>
<th>Female</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N 1237</td>
<td>N 699</td>
<td></td>
</tr>
<tr>
<td>1. Patience</td>
<td>M 14.4</td>
<td>M 14.1</td>
<td>1.871△</td>
</tr>
<tr>
<td>2. Aggressiveness</td>
<td>M 16.4</td>
<td>M 15.8</td>
<td>4.015**</td>
</tr>
<tr>
<td>3. Volition for self-realization</td>
<td>M 16.2</td>
<td>M 16.5</td>
<td>-2.640**</td>
</tr>
<tr>
<td>4. Volition for winning</td>
<td>M 15.5</td>
<td>M 15.3</td>
<td>1.302</td>
</tr>
<tr>
<td>5. Self-control</td>
<td>M 14.3</td>
<td>M 13.9</td>
<td>2.785**</td>
</tr>
<tr>
<td>6. Ability to relax</td>
<td>M 12.6</td>
<td>M 12.3</td>
<td>1.674△</td>
</tr>
<tr>
<td>7. Concentration</td>
<td>M 15.2</td>
<td>M 15.0</td>
<td>1.197</td>
</tr>
<tr>
<td>8. Confidence</td>
<td>M 12.5</td>
<td>M 11.2</td>
<td>8.344**</td>
</tr>
<tr>
<td>10. Predictive ability</td>
<td>M 11.8</td>
<td>M 10.7</td>
<td>7.559**</td>
</tr>
<tr>
<td>11. Judgment</td>
<td>M 12.0</td>
<td>M 10.7</td>
<td>8.844**</td>
</tr>
<tr>
<td>12. Cooperation</td>
<td>M 16.1</td>
<td>M 16.4</td>
<td>-1.835△</td>
</tr>
</tbody>
</table>

Table 3  Comparison of the male mean scores by competition level

<table>
<thead>
<tr>
<th>Competition level</th>
<th>International</th>
<th>National</th>
<th>Kyushu</th>
<th>Prefectural</th>
<th>District</th>
<th>Municipal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N 34</td>
<td>N 286</td>
<td>N 187</td>
<td>N 232</td>
<td>N 278</td>
<td>N 37</td>
</tr>
<tr>
<td>Scale and factor</td>
<td>M SD</td>
<td>M SD</td>
<td>M SD</td>
<td>M SD</td>
<td>M SD</td>
<td>M SD</td>
</tr>
<tr>
<td>1. Patience</td>
<td>M 14.9 2.98</td>
<td>M 15.0 2.77</td>
<td>M 14.5 2.83</td>
<td>M 14.4 2.98</td>
<td>M 13.9 2.75</td>
<td>M 14.4 2.61</td>
</tr>
<tr>
<td>2. Aggressiveness</td>
<td>M 17.9 2.28</td>
<td>M 17.0 3.04</td>
<td>M 16.8 3.02</td>
<td>M 16.5 3.06</td>
<td>M 16.1 3.36</td>
<td>M 14.6 4.05</td>
</tr>
<tr>
<td>3. Volition for self-realization</td>
<td>M 17.4</td>
<td>M 16.7 2.91</td>
<td>M 16.6 2.60</td>
<td>M 16.4 2.93</td>
<td>M 15.7 2.88</td>
<td>M 15.2 2.91</td>
</tr>
<tr>
<td>4. Volition for winning</td>
<td>M 16.1 2.93</td>
<td>M 16.0 2.86</td>
<td>M 15.5 3.09</td>
<td>M 16.0 2.67</td>
<td>M 15.0 2.92</td>
<td>M 15.4 2.85</td>
</tr>
<tr>
<td>5. Self-control</td>
<td>M 15.6 2.97</td>
<td>M 15.0 3.12</td>
<td>M 14.7 3.07</td>
<td>M 13.8 3.32</td>
<td>M 14.2 3.17</td>
<td>M 12.8 3.31</td>
</tr>
<tr>
<td>6. Ability to relax</td>
<td>M 13.9 3.88</td>
<td>M 13.4 3.62</td>
<td>M 12.8 3.93</td>
<td>M 11.8 4.05</td>
<td>M 12.9 4.04</td>
<td>M 10.6 3.80</td>
</tr>
<tr>
<td>7. Concentration</td>
<td>M 15.5 3.24</td>
<td>M 15.7 2.98</td>
<td>M 15.7 2.92</td>
<td>M 14.8 3.17</td>
<td>M 15.1 3.18</td>
<td>M 13.7 3.17</td>
</tr>
<tr>
<td>8. Confidence</td>
<td>M 15.0 2.70</td>
<td>M 13.5 3.04</td>
<td>M 13.0 3.16</td>
<td>M 12.6 3.11</td>
<td>M 11.6 3.26</td>
<td>M 10.5 2.95</td>
</tr>
<tr>
<td>11. Judgment</td>
<td>M 13.4 3.01</td>
<td>M 12.9 3.25</td>
<td>M 12.4 3.25</td>
<td>M 11.9 3.00</td>
<td>M 11.6 3.00</td>
<td>M 10.8 2.65</td>
</tr>
</tbody>
</table>

**p<.01,*p<.05, △p<.10
nation and cooperation among participants from Fukuoka Prefecture in the 1990 National Athletic Meet. Nor were significant differences found between the sexes in volition for self-realization, concentration and cooperation among participants from Kumamoto Prefecture in the 1992 National Athletic Meet (Tokunaga, 1999b).

The competitions in the subjects' participating experiences were investigated and the male mean scores were compared by competition level. Table 3 shows the results. The athletes of international and national-level competitions had higher scores and those of the municipal and district levels scored lower. In the results of one-way analysis of variance, significant differences were found between the competition levels in the total scores and the scores of respective factors and scales except for cooperation. The differences between the competition levels were particularly remarkable with confidence (confidence, decisiveness) and strategic ability (predictive ability, judgment). A similar tendency was observed among the females. The mean scores of the international-level athletes (the highest scoring group) and those of the municipal-level athletes (the lowest scoring group) are shown in Fig. 1. Significant differences were noted between the two groups in all scales except for patience, volition for winning and cooperation.

Because the scores measured by "DIPCA" have conspicuous relationships with the subject athletes' competition levels, length of experience, self-evaluated mental strength, the degree of making full use of one's ability and competition results as explained above, it is suggested that "DIPCA" is a valid evaluation scale for psychological "traits" of athletes and has criterion-related validity.

2. Evaluation scale of psychological competitive ability as psychological "state"

1) Diagnosis of psychological state before competition

Athletes need psychological conditioning toward specific competition. It would be convenient for coaching the conditioning if a method to diagnose the psychological state within a month before competition is available. We therefore conducted the following study to develop a testing method that would serve for this purpose.

The prepared questionnaire comprised 20 questions to find psychological condition prior to competition relating to the 12 scales in DIPCA.2. Using this questionnaire, a survey was conducted on 246 sports club members (high school and university students and non-students, both males and females) with an upcoming competition.

To examine the discriminant validity of the questions, we divided the subjects into the good and poor groups by good-poor analysis and conducted t-test on the means for each question. A significant difference (significance level 1%) was found in every one of the 20 items. Also, in the results of seeking Pearson's correlation coefficient between total score and score for each item, a sig-

![Fig. 2 Change of psychological state profile before competition (individual score).](image-url)
sificant correlation (significance level 1%) was found with every item. The testing with two methods showed that every question item in the questionnaire is valid for determining the psychological condition before competition, and we decided to use all of the 20 items as originally prepared.

High reliability coefficients were found: \( r = 0.771 \) by Spearman-Brown's formula of the split-half method and \( \alpha = 0.789 \) for Cronbach's alpha to show internal consistency.

In order to analyze the factor variability of the questions, factor analysis (principal factor solution, varimax rotation) was conducted, in which five factors had an eigenvalue of 1.000 or higher. In the results of factor analysis accomplished by specifying these five factors, the cumulative contribution was 60.7%. However, because a similarity in contents was noted in factors 1 and 4, factor analysis was conducted again to find sub-scales. Five factors with 9 scales were obtained, that is volition for competition (patience, aggressiveness, volition for self-realization, volition for winning), relaxation, concentration, confidence & strategy (confidence, strategic planning) and cooperation (See Fig. 2).

The POMS by McNair (1971, Yokoyama and Araki, 1994) that is often used as the index for psychological conditioning before competition in Japan consists of 6 scales of "tension - anxiety", "depression - despondency", "anger - hostility", "vigor", "fatigue" and "confusion". All except "vigor" are negative scales (Nagle et al., 1975; Endow and Yamamoto, 1994, 1995; Yamamoto, 1994; Renger, 1993; Morgan and Johnson, 1997). The Psychological Conditioning Inventory (PCI) developed by Inomata et al., (1991, 1996a, 1996b) consists of 7 scales of general vigor, feelings of technical effectiveness, combative spirit, awareness of expectation, feelings of emotional stability, anxiety about competitive failure and feelings of fatigue. Although some of these scales have commonality with the items in our inventory, such items as patience, strategic planning and cooperation that are necessary for athletes are not found in these other scales unlike ours. Our scales are all designed to check positive aspects and therefore are considered to have a more appropriate scale structure for diagnosis of an athlete's psychological state before competition.

After the above noted procedures and giving a proper form for diagnostic testing, we completed the "Diagnostic Inventory of Psychological State Before Competition (DIPS-B.1)" consisting of 20 items with a 5-factor and 9-scale structure (Tokunaga, 1997a, 1999b, 1999c). A survey conducted by using the inventory on the athletes with competitions near at hand revealed that the athletes targeting higher level competitions have higher scores. The survey results indicated that this inventory is a useful tool for coaching psychological conditioning before competition by finding the changes in individual athlete's scores, and criterion-related validity of the inventory was recognized (Tokunaga, 1998).

2) Diagnosis of psychological state during competition

For an athlete determining whether he or she has reached a desirable psychological state during competition (psychological competitive abilities necessary for the event) is most important. As they need a simple means to this diagnose, we conducted the following study to develop a method for testing the psychological state during competition. For the questionnaire, we used 10 items representing the 12 sub-scales from "Diagnostic Inventory of Psychological Competitive Ability for Athletes". Of the 12 sub-scales, we determined that "confidence" represents "confidence" and "decisiveness", and "strategic ability" represents "predictive ability" and "judgment" in view that the issue is to determine whether the sub-scale contents are exercised in the psychological state during competition. The
10 items are patience, aggressiveness, volition for self-realization, volition for winning, self-control, ability to relax, concentration, confidence, strategic ability and cooperation. In order to examine the discriminant validity, reliability and factor validity of the test, we collected responses to the questionnaire from 294 athletes who participated in various competitions in 1997 (Tokunaga et al., 1999). To find the discriminant validity of the questions, t-test on the mean by a good-poor analysis was conducted and Pearson's correlation coefficients were sought between the total score and each item. The results showed a significant difference (significance level 1%) in all 10 items by both methods, and the validity as a test was proven. High reliability coefficients were obtained by Spearman-Brown's formula \( r = 0.811 \) of the split-half method and Cronbach's alpha coefficient \( \alpha = 0.866 \) for internal consistency.

Factor analysis (principal factor solution, varimax rotation) revealed that the questionnaire had a three-factor structure. Their cumulative contribution was 55.3%. Factor 1 contributed 41.7%, with factors 2 and 3 reflecting a minimal contribution. Because of this and for two other reasons, we speculated that the 10 items should be assumed to be one factor. One reason is that, while indicating the importance of the psychological state during competition, Loehr (1987), Garfield (1988), Mikes (1991), Weinberg (1992) and Graham (1992) did not distinguish its factor structure. The other reason is that these 10 items are originally independent factors for Diagnostic Inventory of Psychological Competitive Ability for Athletes (DIPCA.2). The results of factor analysis for single factor, all 10 items indicated a high factor load not less than 0.5 respectively, and we decided to process them as a single factor. The questions are as shown in Table 4.

Loehr (1987) indicated 12 items for athletes' ideal performance state including physical relaxation, calmness and elimination of anxiety, and prepared "Psychological testing for those who showed their best or the worst performance" and "IPS Monitoring Card".

Garfield et al., (1988) prepared "Peak Performance Scales" in which 8 states of peak performance feeling, including "mentally relaxed," "physically relaxed" and "confident" are checked. The feelings during competition vary depending on the sport. For instance, Mikes (1991) reported that "concentration," "calmness" and "confidence" are three essential elements for basketball players to exercise peak performance. Weinberg (1992) distinguished 8 items, including "confidence", "concentration" and "physical relaxation", as contributing to the ideal mental state for tennis players. Graham (1992) proposed 11 items necessary for golf players to enter the zone, including "poised and calm", "physical relaxation" and "fearlessness".

Our selection of items has commonality with

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
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<tbody>
<tr>
<td>1.</td>
<td>I was able to fight to the end without giving up.</td>
</tr>
<tr>
<td>2.</td>
<td>I had a lot of fighting spirit in me.</td>
</tr>
<tr>
<td>3.</td>
<td>I competed with the feeling I would achieve my personal objectives.</td>
</tr>
<tr>
<td>4.</td>
<td>I had a strong will to win.</td>
</tr>
<tr>
<td>5.</td>
<td>I competed as usual without losing my own self-control.</td>
</tr>
<tr>
<td>6.</td>
<td>I competed without getting too nervous thinking about winning or losing.</td>
</tr>
<tr>
<td>7.</td>
<td>I was able to concentrate on the game.</td>
</tr>
<tr>
<td>8.</td>
<td>I was confident of myself.</td>
</tr>
<tr>
<td>9.</td>
<td>My game strategy and situational decisions went well.</td>
</tr>
<tr>
<td>10.</td>
<td>Between and during the game, I encouraged and cooperated with my teammates quite well.</td>
</tr>
</tbody>
</table>
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The features distinguished by these researchers except that we add “cooperation”. They are considered to be appropriate for diagnosing psychological state during competition. Cooperation does not appear in any of the above-mentioned literature, and is considered to be a trait required particularly of Japanese athletes.

Based on the results explained above, we formulated “Diagnostic Inventory of Psychological State During Competition, DIPS-D2” comprising 10 questions as well as checks of both goal-achievement levels and the degree of making full use of one’s ability (Tokunaga, 1999a, 1999b, 1999c).

The relationships of DIPS-D2 with DIPS-A2, DIPS-B1, self-evaluated mental strength, the degree of making full use of one’s ability and competition result were examined respectively by comparing score for each item with the total score.

The relationship with the degree of making full use of one’s ability is as shown in Fig.3. One-way analysis of variance for males, females and the total of both sexes indicated that athletes with a high self-evaluated the degree of making full use of one’s ability had a significantly higher psychological state during competition than those with a low self-evaluated level (Tokunaga et al., 1999). Also, it was revealed that athletes who had higher self-evaluated mental strength or superior results in National Athletic Meets had superior psychological state during competition. Furthermore, it was clearly shown that athletes with higher total scores for psychological competitive ability (DIPS-A2) had higher total psychological state scores during competition (DIPS-D2), and that there is a significant correlation between the total scores for DIPS-B1 and those for DIPS-D2 (Tokunaga et al., 1999). The criterion-related validity of the DIPS-D2 was thereby proven.

In view of the above, it is suggested that both DIPS-B1 and DIPS-D2 are effective evaluation scales for diagnosis of psychological “state” of athletes.

3. Systematization of evaluation scales

The three diagnostic inventories can be formulated into systems as shown in Figs. 4 and 5. Fig. 4 is an evaluation scale system aiming at goal achievement, formulated by clarifying the “trait-state-goal achievement-evaluation” relationships. The correlations between each pair of DIPS-A2, DIPS-B1, DIPS-D2, the degree of making full use of one’s ability and competition results were compared by one-way analysis of variance and chi-square test. The degree of making full use of one's ability had the most significant correlation with DIPS-D2, followed by DIPS-B1 and then by DIPS-A2. It also showed a significant relation with competition results. DIPS-A2 had significant relations with DIPS-B1 and DIPS-D2, and DIPS-B1 was significantly related with DIPS-D2. Based on these results, the system shown in Fig. 4 was pre-
First, Fig. 4 shows that “the degree of making full use of one’s ability and goal achievement” is significantly related to the “psychological state during competition.” When an athlete’s ability has been fully made and the goal has been achieved, it is evaluated as “success” regardless of whether the competition result is a win or a loss. Conversely, if actual ability has not been fully made and the goal has not been achieved, the evaluation is “failure” even if a win is achieved. Repeating “success” in competition is important, because it will increase confidence. Second, the figure shows that the “psychological state before competition” and “psychological competitive ability” are related to “psychological state during competition.” Also shown is that “psychological competitive ability” is related to “psychological state before competition”.

Third, it is clear that “psychological competitive ability” is influenced by competition results, the number of participations in international and national competitions and National Athletic Meets, competition level, length of experience, and other elements. It can be seen that the better the athlete, the higher the psychological competitive ability.

The analysis results of correlations of DIPCA.2 with DIPS-B.1 and DIPS-D.2 indicate that
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"trait" and "state" are significantly correlated. Thus it can be seen that athletes need to increase the psychological competitive ability "trait." Therefore it is important to reinforce by training weak elements from among 12 psychological skills based on the diagnosed results. For instance, an athlete with a low relaxation score is likely to become excessively tense, and needs to be given training on methods to achieve relaxation. Those with lower concentration need guidance on how to focus and maintain concentration. For this, psychological guidance centered on mental training after conducting DIPCA.2 and DIPS-B.1 is required. We therefore prepared "Mental Training Card for athletes (MTCA.2)" as a tool for training psychological competitive ability based on DIPCA.2 and DIPS-B.1 results. MTCA.2 comprises 15 cards explaining the mental training method in simple terms and is designed for easy application by coaches (Tokunaga, 1997b).

Fig. 5 shows the systematization with consideration given to the time of testing and contents of guidance. DIPCA.2 for trait is conducted at the beginning of the season to provide psychological diagnosis and guidance regarding points needing improvement. Next, DIPS-B.1 for prior-to-competition state is conducted to give guidance on psychological conditioning before competition. After competition, DIPS-D.2 for state is conducted to ascertain and give guidance relating to emotional adjustment during competition, goal achievement, and the degree of making full use of one’s ability. Also, in the middle or at the end of the season, DIPCA.2 for trait is again conducted. The results are compared with those obtained at the beginning of the season to diagnose the psychological changes and give guidance.

Fig. 6 shows a three-year transition of DIPCA.2 profile recorded for T.T., a high school swimming club member, as an example (Tokunaga, 2000b). After the initial testing and diagnosis, he was given instructions mainly on relaxation, concentration and image training. Thereafter, as his competition results improved as indicated by winning prizes in Inter-high school Athletic Competition and National Athletic Meet, changes were noted in his DIPCA.2 profile and his total scores, improving from 179 to 219 and then to 230.

Nakagomi (1994) investigated changes in college athletes with DIPCA.2 before and after giving a two-and-half-month seminar, and reported significant improvement of their patience, volition for self-realization, self-control, concentration, confidence, decisiveness, predictive ability and cooperation. Murakami et al. (2000) reported the results of 20 sessions of training for high school tennis players. They significantly improved patience, volition for winning, self-control, relaxation, concentration and confidence, and many of them increased the degree of making full use of one's ability in competitions.

As demonstrated by the examples, the inventories should be a likely tool for strengthening the mental ability of athletes when used for diagnosing
psychological competitive ability of individual athletes, and guidance of appropriate training is given based on the diagnose and also the relationship of the diagnostic results with his or her performance in competitions is analyzed.

When utilized effectively as shown above, we believe these three psychological inventories can be useful in providing psychological guidance to athletes.

**Summary**

In order to develop a method for diagnosing athletes' psychological competitive ability, we have conducting surveys of athletes in various fields since 1986. The survey were conducted on 5,334 athletes over a period of nearly 15 years. Thereafter, we sought the factors, sub-scales and total score for psychological competitive ability to analyze statistically their relationships with various athletic traits, and examined their validity and reliability. The main results are as follows:

1. We developed the Diagnostic Inventory of Psychological Competitive Ability for Athletes (DIPCA.2), as a method for diagnosing athletes' psychological competitive ability as their psychological 'traits.' The inventory comprises 52 questions (including 4 lie scale items), which can be categorized into 12 scales and 5 factors.

2. We developed the following two methods for diagnosing athletes' psychological competitive ability as their psychological 'states.'
   1) One is the Diagnostic Inventory of Psychological State Before Competition (DIPS-B.1) to diagnose athletes' psychological state before competition. It comprises 20 questions (including 2 lie scale items), which can be categorized into 9 scales and 5 factors.
   2) The other is the Diagnostic Inventory of Psychological State During Competition (DIPS-D.2), comprising 10 questions, to diagnose athletes' psychological states during competition.

3. We attempted to systematize the three diagnostic inventories for use in athletes' psychological guidance.

**References**


Tokunaga, M. (2000a) Differences between the sexes, competitive levels and events in the athletes' psychological competitive ability. J. Health Sci. 21: 109-120.<in Japanese: 徳永幹雄, 心理的競技能力の性差, 競技レベル差, 種目差。

Tokunaga, M. (2000b) A study on psychological support to high school swimmers and cyclisis—
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