

# A Study on General Attitudes of Female College Students toward Physical Education Practice : Construction of a Questionnaire of General Attitudes

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## Abstract

Although a questionnaire to measure the general attitude toward physical education practice has been used, its statistical validity and reliability was not examined enough.

The purpose of this study is to construct it through statistically examining validity and reliability. The questionnaire consisting of 76 items, which were selected considering theoretical validity by Noguchi et al., was administered to 1286 college female students. Six items based on the results of item analysis were eliminated, and factor analysis was applied to a correlation matrix, consisting of the remaining 70 items, to determine the factor structure of the general attitude toward physical education practice. As a result, 7 attitude factors were interpreted and 28 items representing each factor were reselected, considering factorial validity and question-content. A questionnaire consisting of 28 items is considered to be very effective and valid, because it has a very high validity, reliability, and practicability.

## Introduction

Attitude is a complex and abstract concept, but widely used among people. The definition of attitude and the ideas on its components are not always consistent, even among researchers<sup>7)21)24)29)</sup>.

College students already took classes of physical education practice in elementary-, junior high-, and high-schools. Therefore, they are considered to develop a certain general attitude toward physical education practice. If students have a favorable attitude toward physical education practice, it will appear as positive behavior in a physical education class in university or it may contribute to control other interrupting conditions influencing learning behavior. Namely, learning behavior seems to be greatly influenced by their attitude. If a teacher is able to understand his students' attitude before they take a class, he will be able to teach them more successfully. For this purpose, a test to measure the attitude toward physical education practice should be constructed.

Although studies<sup>1)2)4)7)10)20)22)23)26)27)28)</sup> on the general attitude toward physical education practice have been performed, it is doubtful whether or not the questionnaire used in each study is appropriate or valid for the above-mentioned purpose. Construction of the new inventory seems to be necessary. To determine the general attitude toward physical education practice

accurately, it's structure is clarified objectively and the theoretical and statistical examination of test items should be done.

The purpose of this study was to construct a questionnaire to measure the general attitude toward physical education practice for college female students, taking into account statistical validity and reliability.

## I. Methods

It is difficult to say that statistical validity and reliability of a questionnaire used to measure the general attitude toward physical education practice were examined enough. Table 1 shows 76 question items, which Noguchi et al.<sup>15-19)</sup> selected and used through an examination of theoretical validity to measure the general attitude toward physical education practice. Attitude is an abstract concept with a broad meaning, and to measure it by a single item is impossible. More items will be necessary to measure it more exactly. Attitude is considered to consist of several composing factors and each question item selected more or less relates to them.

Table 1. A questionnaire on general attitude toward physical education practice  
(PEP=physical education practice)

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- Q1 : PEP is useful for improvement of physical fitness.
  - Q2 : PEP should be done more.
  - Q3 : PEP develops sportsmanship.
  - Q4 : PEP develops quick movement.
  - Q5 : PEP makes human nature rich.
  - Q6 : PEP is all right for only attendance.
  - Q7 : PEP is useful for dissolving stress.
  - Q8 : PEP is a mere play.
  - Q9 : PEP promotes the growth and development of the body.
  - Q10 : PEP gives your life color.
  - Q11 : PEP is troublesome.
  - Q12 : PEP develops disciplined attitude.
  - Q13 : PEP makes body condition better.
  - Q14 : You can express self-existence in PEP.
  - Q15 : PEP is useful for future.
  - Q16 : PEP puts students to shame.
  - Q17 : PEP loosens body tension.
  - Q18 : You can experience delight from the bottom of your heart in PEP.
  - Q19 : PEP should be removed from subjects.
  - Q20 : You can talk with a teacher in PEP.
  - Q21 : PEP makes your posture better.
  - Q22 : PEP makes you a deformed person.
  - Q23 : You can master various motor techniques in PEP.
  - Q24 : PEP develops a fair attitude.
  - Q25 : PEP leaves you with a comfortable excitement.
  - Q26 : You can do without intelligence in PEP.
  - Q27 : PEP develops independent behavior.
  - Q28 : PEP is useful for social life.

- Q29 : PEP is useful for a change of feeling.  
Q30 : PEP gives you a deep impression.  
Q31 : PEP develops teamwork.  
Q32 : You can only feign ignorance in PEP.  
Q33 : PEP releases tension of mind.  
Q34 : PEP can improve motor skill.  
Q35 : You can take a rest in PEP.  
Q36 : PEP is useful for dissolution of an exercise-lack.  
Q37 : PEP develops friendships.  
Q38 : PEP makes a clear character.  
Q39 : PEP is a hindrance of study.  
Q40 : You can learn the safe way of movement in PEP.  
Q41 : PEP develops a feeling of rhythm.  
Q42 : PEP develops leadership.  
Q43 : PEP is very stupid.  
Q44 : PEP is very happy.  
Q45 : PEP develops patience.  
Q46 : PEP develops responsibility.  
Q47 : PEP develops mental power.  
Q48 : PEP develops endurance.  
Q49 : You can enjoy PEP very much.  
Q50 : PEP develops sociability.  
Q51 : PEP develops concentration.  
Q52 : PEP is boring.  
Q53 : You like PEP.  
Q54 : PEP is nonsense.  
Q55 : PEP develops cooperation.  
Q56 : PEP is necessary.  
Q57 : PEP is insignificant.  
Q58 : PEP is eagerly awaiting.  
Q59 : PEP develops an inferiority complex.  
Q60 : PEP develops creativity.  
Q61 : PEP is useful for maintenance and improvement of health.  
Q62 : PEP develops a crooked competition.  
Q63 : PEP develops an attitude getting used to exercise.  
Q64 : PEP has only a role as recreation.  
Q65 : PEP is a state of non-thinking.  
Q66 : PEP is useful even after graduating from a university.  
Q67 : You can not understand why a teacher is necessary in PEP.  
Q68 : You can not expect improvement of technique in PEP.  
Q69 : You enjoy doing activities with other persons in PEP.  
Q70 : PEP has an atmosphere making you produce a desire.  
Q71 : You can not understand the aim of PEP.  
Q72 : PEP is essentially different from playing.  
Q73 : PEP develops ability being able to do energetic motion.  
Q74 : PEP dawdles away and is loose.  
Q75 : Theory and practice is isolated in PEP.  
Q76 : PEP is difficult for developing teamwork and teamplay.

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Note : Item numbers in the other tables is the same as those in this Table.

For the present purpose, the above questionnaire was administered to 1278 college female students, and statistical validity and reliability were examined. Likert's method<sup>11)</sup> was used for scale composition; the subjects respond to each question with any of the following 5 grades; 1=strong disagreement, 2=disagreement, 3=neither agreement nor disagreement, 4=agreement, 5=strong agreement.

### Item analysis 1

The aim of item analysis is to statistically examine and select valid items in addition to a content-examination of each question item.<sup>3)5)6)14)</sup> One of the most important conditions of a good test is validity. Validity can be divided roughly into theoretical validity and statistical validity. Seventy six items shown in Table 1 were selected through the examination of the former's one. Generally, statistical validity can be evaluated by agreement of a measured value and a true-value of an object, but we can not know the latter. Therefore, instead of the real-value, we must examine by statistical agreement between a value assumed as a true-value, i.e., a validity criterion, and a measured value. In general there are 2 types: one in which the validity criterion exists inside a data group and one in which it exists outside a data group. In case of the former, we must make up a total scale replacing it from measured values. If many items selected through an examination of theoretical validity are assumed to measure the same object, a total scale based on their items can become a criterion of validity. Examination of validity for each item is done by the size of a correlation between the total scale and the item. This is called validity of inter-consistency. In this study, the total scale was calculated from the following 4 methods. 1) a sum of raw scores, 2) a sum of standard scores, 3) a first principal component score, 4) a first principal factor score

### Item analysis 2

Besides the mentioned method in item analysis 1, there is a case examining statistical validity from the discriminative power of test items.<sup>14)</sup> Originally, a test attempts to evaluate individual differences or individual's ability. This is based on the idea that test results should discriminate between an upper group and a lower group if a test measures an object exactly. A good or poor analysis method can be given for this purpose. In this study, based on individual's total scores, an upper group (25%) and a lower group (25%) are selected, and means and frequencies of positive or negative responses for each item between both groups are tested statistically. If significant differences between their values of both groups are not found, the item is judged as non-discriminative, or of low validity.

Further, as has already been stated, a 5-point evaluation based on Likert's method was used as a scale. But, the subjects do not always respond with a certain variation from strong disagreement (1 point) to strong agreement (5 point) toward each question item. Many may respond to strong agreement and the score distribution may produce a bias on either side. Therefore, also tests of normal curve and frequency were performed on each item.

Factorial structure of attitude toward physical education practice and examination of factorial validity

Factorial validity of each item is examined in addition to determining the factorial

structure of the general attitude toward physical education practice, using items selected through item analysis. It is assumed that several simple attitude factors in the back of many attitude items exist. Attitude factors are interpreted positively and items with higher factor validity are reselected, considering practicability. Factor analysis procedure is performed as follows: first, constructing a correlation matrix between items, second, applying a principal factor solution to it, and applying orthogonal rotation based on Normal Varimax method to obtain multiple factor solution. After interpreting each factor in considering the size of factor loadings, the factorial structure of the attitude is determined.

#### Examination of reliability

There are some methods also on examination of reliability,<sup>5)6)</sup> and they have strong and weak points. In this study, reliability is examined by a half-split method, which is considered as the best method. Spearman and Brown published a formula calculating a reliability coefficient by a correlation between a total score of tests of 2 groups. On the other hand, inter-consistency is a condition that each item measures the same object with mutual consistency. From this standpoint, also a formula calculating a reliability coefficient is published, i.e., Cronbach's  $\alpha$ -coefficient.<sup>5)6)</sup>

## II. Results and Discussion

### 1. Results of item analysis

Table 2 shows response frequencies of strong disagreement (1 point) and strong agreement (5 point) to each question, test results of normal distribution and significant differences among response frequency, and means and standard deviation for each item. First, seeing frequency, as a whole, students responding to strong disagreement are fairly fewer than students responding to strong agreement. In a test of normal distribution, a score distribution of all items shows a normal curve. And also in test results among response frequency from 1 to 5 points a significant difference is found in all items. From these results, subjects seem to respond to each question with a certain variation. Next, about means, all items show values above 3.0. Because a scale-sign of item numbers 19, 22, 32, 39 and 43 are changed, these results mean that many students respond to disagreement toward the above-item questions. In case of item numbers 29, 31, 36, and 56, it is interpreted that many students respond with agreement or strong agreement. From the above results, it is inferred that ordinary college female students recognize the value of physical education practice and evaluate it highly.

Correlations between 4 total scales (validity criterion) and each item are shown in Table 3. Although all items show significance, 5 items of numbers 7, 26, 35, 72, and 75 have a low value below 0.40 with any criterion. These items seem to measure a different question-content from many other items.

Also test results of mean differences between an upper group and a lower group based on an individual's total score, and frequency of a positive response or a negative one for each item are shown in Table 3. The former shows significant differences in all items, but the latter does

Table 2. Means and standard deviations, response frequency of 1 and 5 points, and test results of normal distribution and frequency.

NO	M	S.D	1(%)	5(%)	ND	FR
1	3.9	0.65	2(0.2)	168(13.2)	1609.6 **	1720.7 **
2	3.4	0.87	15(1.2)	143(11.2)	238.2 **	812.2 **
3	3.5	0.72	9(0.7)	76( 6.0)	425.4 **	1238.5 **
4	3.7	0.70	2(0.2)	107( 8.4)	936.2 **	1360.2 **
5	3.5	0.75	11(0.9)	103( 8.1)	440.4 **	1153.1 **
6	3.9	0.78	9(0.7)	229(17.9)	1380.5 **	1212.7 **
7	3.7	0.74	5(0.4)	113( 8.9)	1031.2 **	1360.7 **
8	3.7	0.72	5(0.4)	147(11.5)	1068.5 **	1325.8 **
9	3.7	0.71	6(0.5)	116( 9.1)	961.6 **	1356.3 **
10	3.4	0.74	7(0.6)	80( 6.3)	335.6 **	1174.6 **
11	3.6	0.82	8(0.6)	140(11.0)	517.5 **	912.8 **
12	3.4	0.69	5(0.4)	58( 4.5)	351.9 **	1339.5 **
13	3.7	0.71	4(0.3)	110( 8.6)	866.3 **	1311.3 **
14	3.2	0.72	12(0.9)	51( 4.0)	194.4 **	1416.8 **
15	3.3	0.71	9(0.7)	43( 3.4)	221.7 **	1359.8 **
16	3.7	0.81	7(0.6)	188(14.7)	764.5 **	940.5 **
17	3.6	0.68	3(0.2)	55( 4.3)	809.1 **	1409.2 **
18	3.4	0.79	13(1.0)	101( 7.9)	328.6 **	1032.1 **
19	4.1	0.87	19(1.5)	438(34.3)	2510.3 **	900.8 **
20	3.0	0.69	26(2.0)	28( 2.2)	224.5 **	1700.6 **
21	3.3	0.64	5(0.4)	30( 2.4)	322.5 **	1689.5 **
22	4.2	0.70	2(0.2)	416(32.6)	2642.7 **	1230.2 **
23	3.9	0.63	1(0.1)	138(10.8)	1724.3 **	1926.2 **
24	3.4	0.66	6(0.5)	42( 3.3)	423.7 **	1461.8 **
25	3.7	0.70	2(0.2)	107( 8.4)	878.4 **	1333.4 **
26	3.5	0.77	13(1.0)	83( 6.5)	533.4 **	1104.7 **
27	3.5	0.65	2(0.2)	47( 3.7)	608.4 **	1422.9 **
28	3.3	0.65	6(0.5)	37( 2.9)	326.8 **	1651.9 **
29	4.0	0.57	2(0.2)	190(14.9)	2326.3 **	2321.9 **
30	3.3	0.71	8(0.6)	63( 4.9)	247.2 **	1472.6 **
31	4.0	0.62	3(0.2)	241(18.9)	2084.2 **	1846.5 **
32	4.0	0.64	1(0.1)	230(18.0)	1720.4 **	1570.0 **
33	3.6	0.68	4(0.3)	68( 5.3)	966.4 **	1480.2 **
34	3.7	0.67	3(0.2)	102( 8.0)	1149.9 **	1552.9 **
35	3.5	0.82	21(1.6)	74( 5.8)	604.8 **	1073.0 **
36	4.0	0.58	0(0.0)	231(18.1)	2272.4 **	2082.6 **
37	3.8	0.66	1(0.1)	166(13.0)	1315.0 **	1498.5 **
38	3.6	0.71	5(0.4)	104( 8.1)	567.3 **	1243.9 **
39	4.1	0.70	5(0.4)	361(28.3)	2318.8 **	1329.8 **
40	3.6	0.65	3(0.2)	82( 6.4)	796.9 **	1438.9 **
41	3.5	0.67	3(0.2)	65( 5.1)	597.2 **	1361.6 **
42	3.2	0.62	6(0.5)	32( 2.5)	353.1 **	1878.8 **
43	4.2	0.68	2(0.2)	414(32.4)	2810.0 **	1395.0 **
44	3.8	0.73	5(0.4)	195(15.3)	1222.2 **	1273.5 **
45	3.6	0.68	2(0.2)	105( 8.2)	794.2 **	1334.3 **
46	3.5	0.65	2(0.2)	61( 4.8)	493.2 **	1457.1 **
47	3.7	0.67	1(0.1)	107( 8.4)	823.1 **	1363.4 **
48	3.8	0.65	2(0.2)	135(10.6)	1274.3 **	1569.9 **
49	3.7	0.73	8(0.6)	154(12.1)	958.7 **	1241.5 **
50	3.3	0.64	3(0.2)	51( 4.0)	361.7 **	1711.0 **
51	3.6	0.68	4(0.3)	93( 7.3)	587.3 **	1329.8 **
52	3.9	0.68	4(0.3)	183(14.3)	1439.8 **	1516.4 **
53	3.7	0.87	21(1.6)	205(16.0)	790.2 **	836.9 **
54	3.9	0.72	5(0.4)	215(16.8)	1482.0 **	1390.9 **
55	3.7	0.67	3(0.2)	109( 8.5)	961.5 **	1431.9 **
56	4.2	0.69	2(0.2)	387(30.3)	2602.4 **	1403.5 **
57	3.9	0.75	8(0.6)	216(17.1)	1341.6 **	1254.6 **
58	3.1	0.76	31(2.5)	63( 5.0)	194.3 **	1577.5 **
59	3.5	0.85	19(1.5)	119( 9.4)	331.4 **	840.2 **
60	3.3	0.64	7(0.6)	37( 2.9)	343.8 **	1698.4 **
61	3.8	0.67	2(0.2)	170(13.3)	1293.0 **	1462.4 **
62	3.7	0.78	12(0.9)	170(13.3)	920.7 **	1116.2 **
63	3.8	0.65	4(0.3)	116( 9.1)	1312.0 **	1651.9 **
64	3.7	0.68	3(0.2)	99( 7.8)	921.6 **	1403.8 **
65	3.9	0.68	4(0.3)	183(14.3)	1402.1 **	1488.3 **
66	3.5	0.76	12(0.9)	82( 6.4)	403.3 **	1120.4 **
67	3.7	0.68	6(0.5)	113( 8.8)	998.0 **	1426.4 **
68	3.5	0.76	4(0.3)	87( 6.8)	640.0 **	1136.5 **
69	3.8	0.69	5(0.4)	141(11.0)	1114.2 **	1407.8 **
70	3.5	0.72	4(0.3)	78( 6.1)	442.9 **	1194.6 **
71	3.5	0.73	7(0.6)	84( 6.6)	443.8 **	1198.4 **
72	3.7	0.72	11(0.9)	107( 8.4)	1043.0 **	1424.5 **
73	3.5	0.68	3(0.2)	64( 5.0)	455.8 **	1356.4 **
74	3.8	0.68	1(0.1)	161(12.6)	1435.2 **	1579.7 **
75	3.2	0.73	16(1.3)	41( 3.2)	168.6 **	1388.3 **
76	3.8	0.72	5(0.4)	169(13.2)	1380.0 **	1484.6 **

Note : ND=normal distribution, FR=frequency, A sign of a negative question-content is changed. \*\*p<0.01

Table 3. Test results of means (t-value) and frequencies (PO and NE) between an upper group and a lower group and a correlation between total scales (TO1 to TO2) and each item.

NO	t-value	PO(4 or 5)	NE(1 or 2)	TO1	TO2	TO3	TO4
1	15.99 **	11.37 **	4.16 **	502	509	508	512
2	18.81 **	13.80 **	10.50 **	558	546	551	551
3	17.43 **	13.92 **	7.91 **	541	549	550	548
4	17.84 **	14.06 **	6.81 **	555	564	566	565
5	17.28 **	13.85 **	7.49 **	562	567	571	571
6	17.48 **	12.49 **	7.33 **	528	521	517	514
7	11.31 **	8.37 **	6.99 **	382	381	377	378
8	13.61 **	9.65 **	5.57 **	435	431	421	423
9	14.55 **	11.80 **	5.02 **	470	477	473	473
10	19.44 **	14.88 **	9.70 **	594	595	600	597
11	22.09 **	16.93 **	9.03 **	588	578	579	578
12	15.86 **	13.39 **	6.99 **	520	526	523	520
13	17.95 **	14.00 **	6.76 **	552	555	554	557
14	17.75 **	13.64 **	10.06 **	546	545	549	547
15	16.14 **	12.50 **	9.14 **	535	539	537	535
16	18.84 **	14.33 **	7.68 **	539	533	529	530
17	16.65 **	13.59 **	7.37 **	535	534	530	534
18	20.88 **	15.57 **	10.30 **	613	607	613	613
19	19.38 **	13.06 **	3.39 **	536	526	525	529
20	14.30 **	10.29 **	10.83 **	464	462	460	459
21	13.92 **	11.37 **	7.50 **	455	464	462	463
22	17.86 **	8.90 **	1.40	470	466	459	460
23	17.06 **	12.65 **	5.37 **	538	544	543	541
24	20.13 **	16.47 **	7.30 **	592	599	600	600
25	21.85 **	16.60 **	6.87 **	602	600	606	606
26	7.43 **	5.88 **	3.15 **	243	240	224	228
27	18.45 **	15.57 **	5.12 **	552	558	560	564
28	16.06 **	12.71 **	7.98 **	499	507	506	503
29	11.77 **	6.84 **	4.00 **	448	450	446	443
30	19.60 **	15.06 **	9.93 **	596	598	606	603
31	19.48 **	12.35 **	3.74 **	628	635	638	638
32	17.18 **	10.51 **	3.15 **	513	509	504	505
33	17.32 **	14.18 **	7.14 **	513	513	512	515
34	22.42 **	16.93 **	6.45 **	631	637	639	643
35	6.72 **	6.52 **	2.80 **	249	246	240	241
36	12.71 **	7.92 **	2.63 **	428	435	432	426
37	17.84 **	12.81 **	4.13 **	564	570	575	575
38	22.87 **	17.88 **	6.87 **	653	659	667	663
39	21.65 **	12.23 **	2.48 **	568	560	559	555
40	15.02 **	12.40 **	4.74 **	452	459	453	457
41	18.43 **	14.87 **	5.75 **	549	558	559	558
42	17.68 **	14.45 **	7.94 **	551	559	562	559
43	24.15 **	12.67 **	3.04 **	647	638	638	640
44	23.78 **	16.23 **	6.19 **	662	653	662	662
45	19.42 **	15.19 **	4.96 **	570	579	584	584
46	21.52 **	17.21 **	6.21 **	601	611	617	618
47	21.57 **	16.35 **	5.54 **	608	620	625	624
48	18.93 **	14.32 **	4.71 **	547	559	562	561
49	22.28 **	16.10 **	6.70 **	656	648	659	662
50	17.42 **	14.26 **	7.58 **	563	573	575	573
51	20.77 **	16.60 **	5.64 **	611	620	625	623
52	22.47 **	15.26 **	4.34 **	642	635	635	632
53	22.76 **	16.30 **	9.00 **	648	637	647	645
54	20.17 **	14.06 **	4.04 **	584	579	579	575
55	19.89 **	15.20 **	5.14 **	571	578	580	579
56	22.26 **	12.99 **	4.37 **	610	603	603	604
57	23.42 **	15.76 **	6.49 **	670	660	663	659
58	17.51 **	13.08 **	11.75 **	586	577	584	584
59	15.27 **	11.94 **	7.94 **	490	479	477	477
60	16.61 **	14.24 **	6.67 **	529	535	536	535
61	17.37 **	12.89 **	4.13 **	510	518	516	514
62	12.77 **	8.77 **	4.64 **	432	427	419	419
63	21.83 **	16.64 **	5.54 **	629	633	635	638
64	17.30 **	13.70 **	4.82 **	510	507	499	496
65	13.87 **	9.71 **	2.04 **	428	425	413	411
66	12.26 **	9.86 **	6.30 **	409	412	406	405
67	14.60 **	11.63 **	3.55 **	473	472	461	457
68	19.74 **	16.17 **	7.28 **	572	572	570	570
69	20.67 **	15.79 **	5.17 **	603	603	611	609
70	24.36 **	18.46 **	8.56 **	666	665	673	676
71	18.66 **	14.78 **	7.45 **	574	573	569	569
72	4.57 **	4.08 **	1.06	159	160	141	143
73	21.92 **	17.69 **	6.73 **	622	630	631	636
74	20.57 **	14.65 **	5.21 **	591	591	588	586
75	10.09 **	9.60 **	5.34 **	340	339	329	331
76	16.82 **	12.28 **	4.38 **	516	520	516	517

PO=positive response, NE=negative response, TO1=a sum of raw scores, TO2=a sum of standard scores, TO3=a first principal component score, TO4=a first principal factor score, \*: P<0.05, \*\*: P<0.01

not show in items 22 and 72. These 2 items as compared with the other ones are judged to be inferior in discriminating power of a negative response.

Summarizing the above results on item analysis, 6 items (number 7, 22, 26, 35, 72, 75) are considered to be low in validity. As a result, 70 items are left for the next analysis.

## 2. Factorial structure of the general attitude toward physical education practice

Table 4 shows a factor pattern matrix obtained by applying factor analysis to a correlation matrix, consisting of 70 items selected through item analysis. In this study, 7 factors explaining about 51 % of a total variance were extracted and interpreted. In general, factors explaining more than 70 % of a total variance are extracted in factor analysis. However, in case of the present study, the above-stated 7 factors were interpreted in weighing interpretation of a factor. In addition, also previous studies<sup>3)8)9)13)19)</sup> using response scale from 3 to 7 points, factors explaining from 30% to 60% of a total variance are extracted and interpreted. Seeing contribution of each factor, the maximum is 7.09 of the third factor and the minimum is 1.92 of the seventh factor. Namely, it means that all factors have a greater variance than that of one variable, because the variance of one variable is 1.0. The first factor (F1) shows a high factor loading over 0.6 with items 45, 46, 47, 48, and 51. From a question-content of these variables, F1 can be interpreted as a mental-effect factor. Female college students seem to have the idea that physical education practice has mental-effect through the experience they took at schools before. The second factor (F2) shows a high loading over 0.6 with items 62, 64, 65, 67, and 74. A question-content of these variables shows a minus or negative impression toward physical education practice. So to speak, F2 is considered to deny the value of physical education practice. Therefore, F2 can be interpreted as a value-negation of physical education practice factor. The third factor (F3) can be interpreted as a good feeling toward the physical education practice factor. Because F3 is defined mainly by items 2, 44, 49, 53, and 58, which show a good feeling toward physical education practice, as shown by expressions like "being happy", "like", "be eagerly awaiting", and "do more". Using a similar procedure, F4 to F7 were interpreted as follows; physical- and technical-effect factor (F4), character shaping factor (F5), physical-and mental- tension relaxation factor (F6), future-and social-value factor (F7). From the above results, the factorial structure of the general attitude toward physical education practice is considered to be composed of the above-mentioned 7 factors.

## 3. Selection of effective items and reliability

Although there are some methods selecting effective items to estimate a factor<sup>12)</sup>, in case of the present study, the simplest method, i.e., selecting some variables with a higher factor loading, was used, weighing the practicability. First, 4 items of numbers 45, 46, 47, and 51 were selected from F1, i.e., a mental-effect factor, because these showed a higher value over 0.60. An item 51 is a somewhat lower value than an item 48, but the latter's question-content is nearer to that of the other 3 items and the former's content seems to show the meaning of physical fitness stronger than that of mental fitness. Therefore, item 51 was selected instead

Table 4. Factor pattern matrix

NO	F1	F2	F3	F4	F5	F6	F7	C
1				705				576
2			702	532				558
3				612				519
4					475			582
5								454
6		-453	419					473
8		-493						489
9				585				483
10			409					497
11		-450	547					556
12					529			479
13				515				488
14			407		477			460
15							540	566
16		--532						442
17						473		485
18			550					500
19			477					467
20					456			367
21					544			456
23				468				428
24	419				455			505
25			481					456
27								406
28							455	524
29						578		506
30			450					449
31	446							484
32		-592						420
33						565		525
34				602				579
36				424		425		521
37	427							437
38	411							579
39		-518						497
40								361
41	477							437
42	468				454			483
43		-592	446					599
44			720					682
45	742							658
46	719							635
47	758							699
48	702							678
49			725					690
50	509							563
51	661							574
52		-563	473					580
53			793					731
54		-597						530
55	538							461
56			470					537
57		-554	590					680
58			694					567
59		-494						477
60	503							404
61				567				476
62		-645						524
63								430
64		-643						494
65		-643						463
66							585	476
67		-634						465
68		-462						417
69			447					482
70			508					528
71		-575						457
73	417				439			522
74		--613						516
76		-519						446
P	7.093	7.479	7.722	4.832	4.112	2.773	1.924	35.9
K	10.133	10.685	11.031	6.903	5.875	3.961	2.749	51.3

Note: NO is the same as that in Table 1.  
 A factor loading below 0.40 is omitted.  
 C=communality, P=contribution,  
 K=a degree of contribution to a total variance

of item 48 with a somewhat higher loading. Also on the other 6 factors, based on a similar procedure, items representing each factor were selected. The following shows the item numbers selected from each factor : 54, 62, 64, and 65 from F2, 2, 44, 49, and 53 from F3, 1, 9, 34, and 61 from F4, 5, 12, 24, and 42 from F5, 17, 29, 33, and 36 from F6, 15, 28, 40, and 66 from F7 (Numbers are the same as those in Table 1). As a result, 4 items were selected from each attitude factor, respectively. A questionnaire measuring the general attitude toward physical education practice consists of 28 question items.

A correlation coefficient between sums of 70-item raw scores and 28-item raw scores had a very high value of 0.970. This means that the attitude domain measured by 28 items selected through an examination of factor structure is almost the same domain as that measured by 70 items selected through item analysis. Therefore, 28 question items seem to be excellent in practicability. Further, a correlation coefficient between a sum of 28 items and a sum of respective 4 items representing 7 factors was 0.773, 0.616, 0.709, 0.739, 0.782, 0.689, and 0.725. From this result, it is inferred that each factor has a relatively high relationship with the domain measured by 28 items.

On the other hand, reliability is one of the most important conditions for a good test.<sup>5)6)12)</sup> Spearman and Brown's reliability coefficient and Chronbach's  $\alpha$ -coefficient of 70 items selected through item analysis were 0.967 and was 0.967, respectively. And, the above-mentioned values for 28 items finally selected in this study was 0.916 and 0.916, respectively. Any value is considered to be very high as compared with those obtained in the former study<sup>3)13)25)</sup>.

Concluding, a questionnaire consisting of 28 items selected in this study is considered to be very high in statistical validity and reliability, and also in practicability.

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