CHANGES IN INDIVIDUAL RESILIENCE AFFECTED BY GROUP CHARACTERISTICS: FOCUSED ON THE HOMOGENEITY AND HETEROGENEITY OF GROUPS

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How to cite this article: Ueno, Y. & Hirano, M. (September, 2017). Changes in individual resilience affected by group characteristics: focused on the homogeneity and heterogeneity of groups. Journal of Physical Education Research, Volume 4, Issue III, 48-60.

ABSTRACT

The effects of group characteristics (homogeneity and heterogeneity), on changes in individual resilience through group activities were examined. Participants were students enrolled in Japanese universities. The survey was conducted twice, in early April (pre-program) and mid-July (post-program). Resilience was measured by employing the Bidimensional Resilience Scale (Hirano, 2010). Results of the analysis revealed the scores of all the subscales with the exception of "vitality" significantly increased post-program compared to pre-program. Subsequently, participants were classified into two types of teams depending on the standard deviation (SD) of the scores of innate and acquired resilience factors pre-program; homogeneity and heterogeneity teams with a low and high SD, respectively. Intraclass correlation coefficients between teams and individuals at each point of time were calculated. Consequently, the hierarchy between teams and individuals was confirmed post-program. "understanding others" in homogeneity groups were extracted based on scores of innate resilience factors and post-program, "self-understanding" in heterogeneity groups, were also extracted based on the scores of innate resilience factors. The results suggest the effectiveness of practice and intervention programs based on different effects of group characteristics, namely, homogeneity and heterogeneity, on individual resilience.
Keywords: Resilience, multilevel, Japanese university students.

1. INTRODUCTION

Resilience has been defined as "the process of, capacity for, or outcome of successful adaptation despite challenging or threatening circumstances" (Masten,

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Best, & Garmezy, 1990). It has been reported that high resilience reduces the impact of stress caused by negative incidents, and not only facilitates an individual's internal and external adaptation, but also contributes to self-development in difficult conditions and the acquisition of well-being (Ueno, Iimura, Amemiya, & Kase, 2017). Grotberg (2003) stated resilience is an ability that everyone can acquire. To date, factors that comprise resilience have been investigated from various perspectives in Japan and other countries (e.g., Connor & Davidson, 2003; Oshio, Nakaya, Kaneko, & Nagamine, 2002). Furthermore, some researchers have indicated there are two types of resilience factors: those that can be easily acquired and those that cannot (American Psychological Association, 2013). Hirano (2010) developed the Bidimensional Resilience Scale (BRS) for measuring resilience factors from two aspects: innate resilience factors and acquired resilience factors that are strongly related to temperament and character, respectively. The BRS is based on the Temperament Character Inventory developed by Cloninger, Svrakic, and Przybeck (1993). In other words, it is thought an individual's resilience has two aspects, namely, an innate aspect and an aspect acquired through learning. Moreover, it is assumed the quality of resilience is dependent on the level of an individual's development.

Various educational and psychological interventions have been conducted to improve resilience considering many are of the opinion that it is an ability that can be acquired through personal development. However, a systematic framework for acquiring resilience has not been established yet, even though a practical approach has been accumulated in various fields. The American Psychological Association (2013), for example, listed ten factors for developing resilience; these include, among others, the following: "make connections," "accept that change is part of living," and "look for opportunities for self-discovery." After reviewing resilience programs executed in school education in Europe and America, Hara and Tsuzuki (2013) reported that they are classified into three types: 1) skill-oriented programs; 2) experience-oriented programs; and 3) environment-oriented programs. Takatsugi (2010) suggested that positive experience might be one of the factors that helps to form resilience in school education. In addition, success in learning, achieving good results in sports and/or music, approaching work responsibly at school, and building good relationships with teachers might also be effective for forming resilience. Intervention methods conducted to date have mainly been based on cognitive behavioral therapy with both individuals and groups. However, the effect sizes indicating the effect of intervention have been diverse, and further consideration is required (Robertson, Cooper, Sarkar, & Curran, 2015). On the other hand, resilience is a phenomenon obtained through interaction with the environment (Lepore & Revenson, 2006), and correlations between individuals and the environment cannot be excluded. When designing

intervention programs that aim at developing resilience, a dynamic approach should be followed that considers groups and individuals. In Japan, it is difficult from a practical perspective to introduce intervention programs targeted at only individuals because of time and personnel constraints. However, group-level intervention programs should be systematized for an effective approach.

Recently, resilience studies have been conducted from the perspective of a multilevel approach in the fields of social psychology and sport psychology (e.g., Morgan, Fletcher, & Sarkar, 2013; Ozaki, Yonezawa, & Negayama, 2015). A multilevel approach is a method that may be employed to analyze hierarchical data of micro (individuals) and macro (groups) levels. Hierarchical data are "nested data obtained through sampling consisting of two or more stages" (Shimizu, 2014). Conventional studies on resilience have focused on only individuals. Recently, however, it has been recommended that group-level variables such as schools or classes consisting of individuals be examined. Kikuchi (2014), for example, suggested the concept of "team resilience," which he defined as "team members' belief in an ability of the team to recover from negative conditions, such as falling in a depressive mood, a decline in morale, or getting nervous, caused by facing difficult situations," and noted that team resilience affected individual resilience. Lyons, Fletcher, and Bariola (2016) reported that group-level resilience predicts individual-level resilience and contributes to individual mental health, life satisfaction, and promotion of well-being; accordingly, they suggested the effectiveness of a group-level approach for developing individual resilience. Such perspectives are often shown in sports activities. Furthermore, studies on the concept of team resilience have been conducted (Morgan *et al.*, 2013). It is the norm for athletes to belong to teams and hence, nested data of micro (individuals) and macro (teams) levels are presumed (Ueno, Mieda, & Oshio, 2017). It is highly possible to facilitate changes in individual resilience through group activities. In addition, the group-level approach is regarded as a realistic support measure in educational and psychological support settings.

The present study was preparatory research to obtain findings related to interactions between individuals and groups. The aim of this study was to establish an effective group-level intervention approach method at schools, where group-level intervention is needed. Concrete changes in university students' resilience through group activities in a physical education class were examined from two perspectives: intrapersonal changes and the effects of group characteristics on intrapersonal changes. A physical education class was selected as the research subject because the aim of this study was to examine the effects of group activities and groups themselves on changes in individual resilience, and not attempt to evaluate a specific resilience program. Moreover, group activities

are easily introduced in a physical education class. Teams were randomly organized. Through group-based sports training executed during the next four months, changes in individual resilience were examined. Furthermore, types of group characteristics that would affect individual resilience were examined. Hida (2014) and Kinjo (2015) reviewed what are desirable learning groups for problem-solving learning; they found groups with high heterogeneity experienced more positive effects such as various choices (Falk & Johnson, 1977), a wide perspective (Hoffman, 1979), and better performances, compared to groups with high homogeneity. To date, various criteria have been used to classify group members into either a homogeneity or heterogeneity group; these include sex differences and one's major field of study at university (Yamaguchi, 1997), academic ability (Sugie, 2011), personality traits (Hoffman & Marier, 1961), and scores of psychological scales (Shirakashi, 1978). It is considered important to examine group effects from two aspects, homogeneity and heterogeneity, in order to develop intervention methods based on group activities in school education settings. The survey period of this study was only four months. We used Hirano's BRS (2010), which can measure both innate resilience factors and acquired resilience factors to examine changes in individual resilience. In addition, participants were classified into two groups depending on the level of dispersion (*SD*) of resilience scores: the homogeneity group with a low *SD* and the heterogeneity group with a high *SD*, so as to investigate hierarchy between groups and individuals.

2. METHODS AND MATERIALS

2.1 Participants and the Period of Study

The survey was conducted from early April to mid-July in 2016. The participants were students enrolled in universities in the vicinity of Tokyo ($N = 72$, 26 males, and 46 females, mean age = 18.2 years, $SD = 0.4$). The survey was conducted twice, in early April (pre-program) and mid-July (post-program). The obtained responses that had omissions or mistakes were excluded, and the valid responses ($N = 71$, 26 males, and 45 females, mean age = 18.2 years, $SD = 0.4$) were analyzed.

2.2 Procedures

A questionnaire that employed BRS was completed twice, in the first author's class. Teams were organized randomly without determining homogeneity and heterogeneity groups intentionally, in the natural conditions of a usual sports

training class. In total, 13 mixed teams of men and women were organized; each team consisted of 4-6 members. The program was executed once a week for 15 weeks and consisted of one session of 90 minutes. The program involved sports training performed by teams and among other sports, included volleyball, badminton, and table tennis. Prior to the survey, the ethical considerations, such as protection of personal information and confidentiality were explained to the participants. They were also made aware that the obtained data would not affect their grades. Consent to participate in the study was obtained from all the participants.

2.3 Questionnaire

Resilience was measured by employing the BRS, which was developed by Hirano (2010). This scale consists of four subscales of innate resilience factors: optimism, e.g., I think that things will work out on most occasions in any case; control, e.g., I can control my feelings even if there is a disagreement; sociability, e.g., I have been good at preserving friendships since I was a child; and vitality, e.g., "I can carry out decisions through to the end." It also consists of three subscales of acquired resilience factors: solve a problem, e.g., When I am faced with unpleasant situations, I try to gather information to solve the problem; self-understanding, e.g., I understand my personality well; and understanding others, e.g., I am good at understanding others' ways of thinking. The reliability and validity of the BRS have been confirmed (Hirano, 2011, 2012). The BRS has a five-point scale that ranges from strongly disagree (1 point) to strongly agree (5 points). A high score indicates that innate/acquired resilience factors were considered higher.

2.4 Statistical Analysis

HAD15.011 (Shimizu, 2016), statistical analysis software, was used for the analysis. Firstly, in order to examine the changes in individual resilience between pre- and post-program, a paired *t*-test was conducted. Secondly, to examine the hierarchy between individuals (micro) and groups (macro) of the participants' resilience, intraclass correlation coefficients (ICC) were calculated. Thirdly, participants were classified in the homogeneity group and heterogeneity group, based on the *SD* of the total scores of the innate and acquired resilience factors at the first point of time. The former showed that the *SD* was lower and the latter showed the *SD* higher than the national average. ICC were calculated so as to examine the micro-macro hierarchy of each group. A statistical significance level of 5% was set for this study.

3. RESULTS

3.1 Changes in individual resilience through group activities

A paired *t*-test was conducted using the scores of pre- and post-program individual resilience, which aimed to investigate changes in individual resilience through group activities (Table 1). The results of analysis indicated the following scores were significantly higher in post-program, compared to pre-program: innate resilience factors: $t(70) = 5.49$, $p < .001$, $d = .48$, optimism: $t(70) = 3.99$, $p < .001$, $d = .41$, control: $t(70) = 3.99$, $p < .001$, $d = .42$, sociability: $t(70) = 4.59$, $p < .001$, $d = .38$. acquired resilience factors: $t(70) = 4.96$, $p < .001$, $d = .48$, solve a problem: $t(70) = 3.40$, $p < .01$, $d = .41$, self-understanding: $t(70) = 3.91$, $p < .001$, $d = .38$, and understanding others: $t(70) = 2.85$, $p < .01$, $d = .30$. However, a significant difference was not shown in vitality: $t(70) = 1.89$, *n.s.*, $d = .17$.

Table 1: Paired *t*-test on changes in individual resilience

Variable	Pre		Post		*t*-value	*df*	Cohen's *d*
	Mean	*SD*	*Mean*	*SD*			
Innate resilience factors	40.16	(6.65)	43.32	(6.65)	5.49 ***	70	.48
Optimism	10.89	(2.49)	11.87	(2.34)	3.99 ***	70	.41
Control	9.39	(1.86)	10.24	(2.15)	3.99 ***	70	.42
Sociablity	9.39	(2.61)	10.34	(2.31)	4.59 ***	70	.38
Vitality	10.48	(2.41)	10.87	(2.21)	1.89	70	.17
Acquired resilience factors	31.79	(4.81)	34.17	(5.08)	4.96 ***	70	.48
Solve a problem	10.27	(2.06)	11.13	(2.16)	3.40 **	70	.41
Self-understanding	10.41	(2.25)	11.27	(2.32)	3.91 ***	70	.38
Understanding others	11.11	(2.16)	11.78	(2.20)	2.85 **	70	.30

$^{**}p < .01$, $^{***}p < .001$

3.2 Correlations between group characteristics and individual resilience

Correlations between group characteristics and individual resilience were examined by calculating ICC between 13 teams and individuals. The results indicated a significant value only in post-program self-understanding (ICC = .17, $p < .05$). Ozaki and Yoshida (2011) and Shimizu (2014) stated it is possible that when the ICC value is .10 or more and significant, data are nested in a group. ICC is an index that depicts intra-group similarity, which is a criterion of judgment on

whether interpretation should be done on a micro- or a macro-level (Haga, Takano, Hanyu, Nishikawa, & Sakamoto, 2016; Shimizu, 2014). It was confirmed that interpretation on a macro-level would be required in specific resilience subscales.

Based on the results above, we examined what type of group characteristics would affect individual resilience by referring to previous studies (Hida, 2014; Kinjo, 2015), that classified group characteristics into homogeneity and heterogeneity. As a variable that would be a criterion of classification, total scores of pre-program innate and acquired resilience factors were used. The mean scores and *SD* of resilience scores were calculated depending on the team. Teams that had lower *SD* values than the mean were regarded as homogeneity groups, and those that had higher *SD* values than the mean were regarded as heterogeneity groups (Table 2). In order to investigate hierarchy between teams and individuals, ICC was calculated using the data of the two groups (Table 3). The results showed significant values in post-program understanding others (ICC = .29, $p <$ .05) in the homogeneity group, and in post-program self-understanding (ICC = .38, $p < .01$) in the heterogeneity group, classified as innate resilience factors. On the other hand, significant ICC values were not confirmed in two groups, classified as acquired resilience factors.

Table 2: Fundamental statistics of resilience of each team and classification into homogeneity and heterogeneity groups

Variable	Team1 (n = 6)	Team2 (n = 5)	Team3 (n = 6)	Team4 (n = 6)	Team5 (n = 5)	Team6 (n = 4)	Team7 (n = 5)	Team8 (n = 6)	Team9 (n = 6)	Team10 (n = 5)	Team11 (n = 5)	Team12 (n = 6)	Team13 (n = 6)
Innate resilience factors	40.00	42.40	41.33	38.50	45.20	38.25	36.60	37.00	43.83	37.60	42.80	41.17	37.33
	(4.47)	(3.58)	(8.55)	(7.82)	(5.50)	(4.50)	(10.62)	(4.00)	(7.88)	(7.30)	(7.05)	(4.96)	(6.31)
	Homo	Homo	Hetero	Hetero	Homo	Homo	Hetero	Homo	Hetero	Hetero	Hetero	Homo	Homo
Acquired resilience factors	30.83	31.60	30.33	33.00	34.00	29.25	32.20	29.67	33.83	31.80	33.60	32.33	30.67
	(6.24)	(3.51)	(3.88)	(6.69)	(5.10)	(3.77)	(6.72)	(4.55)	(4.83)	(4.55)	(5.94)	(5.01)	(2.07)
	Hetero	Homo	Homo	Hetero	Hetero	Homo	Hetero	Homo	Homo	Homo	Hetero	Hetero	Homo

Note. Homo: homogeneity group, Hetero: heterogeneity group, Upper row: mean scores (*Mean*), Lower row: standard deviation (*SD*)

Values indicate scores of Pre-innate and acquired resilience scores of each team.

Based on innate resilience factors (SD_{Mean} = 6.35) and acquired resilience factors (SD_{Mean} = 4.84), those lower than SD_{Mean} were classified into the homogeneity group and those higher than SD_{Mean} were classified into the heterogeneity group.

Table 3: Interclass correlation coefficient of homogeneity groups and heterogeneity groups

		Intraclass correlation coefficients			
	Variable	Innate resilience factors		Acquired resilience factors	
		Homogeneity groups (6 teams, $n = 32$)	Heterogeneity groups (7 teams, $n = 39$)	Homogeneity groups (7 teams, $n = 38$)	Heterogeneity groups (6 teams, $n = 33$)
Pre	Innate resilience factors	.18	-.05	.01	.00
Post	Innate resilience factors	-.06	-.06	-.10	-.02
Pre	Optimism	-.08	.01	.11	-.17
Post	Optimism	-.10	.17	.16	-.12
Pre	Control	.16	.00	.02	.11
Post	Control	-.03	-.01	-.18	.18
Pre	Sociability	.13	-.06	.01	-.05
Post	Sociability	-.08	-.02	-.09	-.04
Pre	Vitality	-.03	.12	.13	-.04
Post	Vitality	-.06	.04	-.03	-.03
Pre	Acquired resilience factors	-.07	-.12	-.03	-.17
Post	Acquired resilience factors	.14	.03	-.13	.13
Pre	Solve a problem	.08	-.13	.00	-.09
Post	Solve a problem	-.12	-.08	-.03	.06
Pre	Self-understanding	-.11	.18	.09	-.10
Post	Self-understanding	-.12	.38 **	-.06	.11
Pre	Understanding others	-.01	.09	.12	-.09
Post	Understanding others	.29 *	-.09	-.11	.16

$^*p<.05, ^{**}p<.01$

4. DISCUSSION

4.1 Changes in individual resilience: Changes in individual resilience through group activities were found in this study. Acquired resilience factors and innate resilience factors changed, that is, resilience scores increased post-program compared to pre-program, except vitality. To date, only a few longitudinal studies have been conducted on changes in resilience through group activities. Ueno and Suzuki (2016) implemented a longitudinal study with athletes on resilience functions during a period of competition. They were surveyed at on three occasions: in spring, summer, and autumn. Resilience scores on the third occasion

were higher, compared to the first occasion. Imamura, Yamamoto, Izumi, Tokushima, Tanigawa, and Inui (2013) conducted a longitudinal study during two years with top athletes; results revealed resilience changed with the course of time. It has been suggested that athletes might acquire resilience through interactions with other athletes who have various attributes, and it is possible that group activities might facilitate changes in individual resilience (Shibukura, 2012). Saito and Okayasu (2011) indicated that environmental factors such as important others and social support might facilitate resilience and have positive effects on stress responses and self-esteem in sports settings as well as other situations. It is important to have interactions with groups and others to facilitate individual resilience. Kikuchi (2014) and Lyons et al. (2016) reported team resilience had a positive correlation with individual resilience. Considering the studies outlined above and the results of the present study, it is suggested that group activities in school education could develop individual resilience, and not only facilitate subject learning, through dynamic interactions between students and people around them.

4.2 Correlations between group characteristics and individual resilience: An ICC value between teams and individuals who reach a certain standard was confirmed only post-program self-understanding. It was suggested intra-group similarity increased through group activities (sports training) conducted during four months. Subsequently, group characteristics that created a hierarchy between teams and individuals were examined. The results showed values that reached a certain standard post –program understanding others in the homogeneity group were classified based on the *SD* of innate resilience and post-program self-understanding in the heterogeneity group were classified based on the *SD* of innate resilience, which suggests the necessity of macro-level interpretation. Previous studies conducted by Hida (2014) and Kinjo (2015) have reported there are different merits and demerits in the "interpersonal aspect" and "learning aspect" between homogeneity and heterogeneity groups. For example, homogeneity groups are superior in fluent communication, prediction of others' behaviors, and control, whereas they are inferior in mutual stimuli and creativity. On the other hand, heterogeneity groups have difficulties in communication and show a decline in group cohesiveness, whereas they have newer and wider perspectives as well as abundant information sources. These findings suggest that performances differ, and depending on the group characteristics and desirable individual activity, patterns change. In a homogeneity group, understanding of others is enhanced since it includes individuals with similar resilience, whereas, in a heterogeneity group, self-understanding is improved by interacting with others who have different resilience. The results above support the findings of previous studies. However, Nagata (2003) and Hida (2014) indicated when heterogeneity

among group members becomes apparent, for maintaining the group, a movement to create homogeneity among members tends to emerge. Furthermore, Miura and Hida (2002), in a study conducted on university students, found a group consisting of members with both high variety and high similarity in ideas demonstrated creative performances, and variety and similarity have a synergetic effect. It cannot be decided which type is better, but there might be an appropriate level of homogeneity and heterogeneity, depending on the tasks and aims. Based on the results above, it was revealed that group characteristics affect individual resilience, and the effects are different between homogeneity and heterogeneity.

5. CONCLUSION

Through this study, changes in individual resilience through group activities and the effects of group characteristics on individual resilience were revealed. The following limitations were noted. Firstly, a comparison with a control group for individual activities was not conducted. If the effects of group activities are indicated, a control group consisting of only individual activities should be established and compared. In addition, the research design was generated without considering the effects of an actual program, since the intervention conducted was based on group activities. With regard to the assessment of individual or group activities, a comparison based on the content of programs should be conducted. Secondly, this study confirmed only intra-group similarity using ICC. It was not clarified whether homogeneity and heterogeneity groups actually facilitated resilience changes. The aim of this study was to investigate what types of group characteristics are nested in individual resilience, and how hierarchy conditions are created. Future studies should examine long-term changes in resilience in homogeneity and heterogeneity groups. Thirdly, this study examined characteristics of groups based on only the *SD* of resilience indices. However, resilience is an adaptation to the environment (Ueno et al., 2017). Performance indices, namely, how people can flexibly deal with changes in tasks, from simple tasks to complicated tasks, should be examined. Consequently, a comparison with indices that have been used for classifying group characteristics into homogeneity and heterogeneity could be conducted. Despite these limitations, this study has indicated that group characteristics are important factors of changes in individual resilience. More multi-faceted studies that examine correlations between group characteristics and individual resilience are needed.

6. ACKNOWLEDGMENT

Ueno, Y. & Hirano, M. (September, 2017). Changes in individual resilience affected by group characteristics: focused on the homogeneity and heterogeneity of groups. Journal of Physical Education Research, Volume 4, Issue III, 48-60.

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