Physical and Mental Changes among High School Students in Fukushima, a Disaster–stricken Area, Following Continuous Sports Lessons Taught by International and Olympic Level Athletes

Tomohiro NAGATSUKA*, Yuko KODAMA**, Shu HAYAKAWA**
Akinobu HARA*, Tomoko MATSUMURA**, Takeo HIRATA* and Masahiro KAMI**

Abstract

Background: Research on the effects of disaster–relief by professional athletes has yet to be conducted.

Methods: We investigated the impact of continuous sports lessons, by professional athletes, on the mental and physical health of the participants and the athletes. The participants were high school students of Soma High School. Lessons started in June 2011; as of August 2012, seven lessons have been held. During the four lessons between September and December 2011, we collected qualitative and quantitative data by recording each student’s event records and distributing a free response questionnaire to students and athletes.

Results: Participants included 45 students and 16 athletes. All the students established new event records. Numerical evaluation by students on perceived physical competence, self-efficacy, and perception of organizational changes failed to show any significant changes, while subjective evaluation by students identified three important categories: “emotional response”, “motivation”, and “content of instruction”. Both students and athletes developed their interpersonal relationships from distant to close, and perceived enhancements in their psychological state during study periods.

Conclusions: A trusting relationship was established between students and athletes through continuous sports lessons held in disaster stricken regions, contributing to fruitful outcomes for both students and athletes.

Key words: International and Olympic Level Athletes, Japan Earthquake, Track and Field, High School Students, Motivation

1. Introduction

On March 11, 2011, a devastating earthquake struck the eastern coast of Japan. It was the most powerful earthquake ever recorded in Japanese history; the 9.0 magnitude tremor triggered massive tsunamis, which caused nuclear, financial, and humanitarian crises. Countries around the world immediately responded to these crises, providing both financial and ma-
terial aids to the disaster–stricken areas; as of March 8, 2012, over $725,808,061 has been sent to these regions\textsuperscript{1}. Various organizations around the world, including professional sports teams, have taken part in the disaster relief\textsuperscript{2}. In 2011, the Major League Baseball Organization sent $500,000 to the Japan Committee for UNICEF, and continued its support in the relief by fundraising donations throughout each Major League Baseball season\textsuperscript{3}. Many Japanese professional athletes have made donations, and some have visited disaster–stricken areas to physically and psychologically support the victims\textsuperscript{4}. For instance, in Soma city of the Fukushima prefecture, professional athletes host continuous sports lessons and workshops for high school students as a form of relief effort.

Research on sports, disasters, and student’s mentality has been conducted; examples include the effect of physical activity on academic outcomes\textsuperscript{5,6}, studies on methods to counteract potential terrorist threats and natural disasters in host regions of athletic events\textsuperscript{7} and research on excelled performance of sporting teams in disaster–stricken regions\textsuperscript{8}. However, a thorough study on the direct support for disaster victims by professional athletes and its impact on the physical and mental health of those involved has yet to be conducted\textsuperscript{9}. Hence, the present study sought to determine the physical and mental health impact of continuous sports lessons by professional athletes in a disaster–stricken area: Soma city in Fukushima prefecture.

2. Methods

2.1 Participants

The sample consisted of 42 students in Soma High School and 16 athletes.

2.2 Measures

2.2.1 Objective evaluation; To assess the physical impact of these workshops, we collected event records of each student prior to participation. We then recorded their newly established records after each lesson and conducted comparative analysis.

2.2.2 Subjective evaluation; A questionnaire was based on Aoki’s evaluation criteria (the reliance of the subscale depends on marks) to evaluate the students’ perceived emotions, athletic mentalities, and internal motives\textsuperscript{10}. Of the six categories, three (i.e. perceived physical competence, self–efficacy, and perception of organizational changes) were assessed with numerical scales. The remaining categories contained free response items\textsuperscript{11}. A similar free response questionnaire was distributed to the participating athletes. We surveyed their reasons for participation, instruction methods, and perceived physical and psychological states.

Assessments were performed immediately after each workshop to obtain accurate data.

2.3 Procedure

Lessons were held for five times from September to December 2011.

Questionnaires were obtained from the students who participated in the second, third, forth, and fifth lessons.

Each lesson was held on a Sunday and lasted for two to three hours; they were hosted outdoors during sunny days and indoors on rainy days. The program of instruction was constructed mainly by the leader who was selected from the athletes every instruction (Table 1). The program was considered to have not only technical aspects but also student’s mental and lifestyle aspects.

2.4 Data analysis

2.4.1 Statistical analysis

Subjective data obtained from quantitative assessments are presented as means with standard errors. Analyses of variance (ANOVA) were used for statistical analysis. Data were analysed using JMP ver. 8.0 (SAS Institute, Inc., Cary, NC). Statistical significance was set at $p < 0.05$. The missing values
publishing their personally identifiable information in the study.

3. Results

3.1 Participant characteristics

Eight of the participating students were in their first year and seven were in their second year of high school; the last was in the third year of middle school. There were ten male and six female students. Their specialties consisted of the short distance event (100–400 m) \(n = 3\), the middle distance event (800–1500 m) \(n = 5\), and the long distance event (3000 m–) \(n = 7\). Furthermore, six students participated in all the four workshops, a student participated in three workshops, six participated in two workshops, and two participated in one workshop. During the study periods, two students withdrew from club activities and four students transferred back to the schools that they were attending prior to the disaster, resulting in a final sample size of ten students.

Table 2 presents the background information of the coaching athletes. A total of six athletes, of ages ranging from 24 to 31, participated in this study. Of these athletes, two participated in all the four workshops, one participated in three workshops, one participated in two workshops, and two participated in one workshop. Four athletes were professionally active while one was retired. With notable achievements, athletes A, B, and D competed in the June 2012 Japan Championships in Athletics and athletes

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Program of instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main contents</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Technical and mental instruction to every students by making 1 group per 5 to 6 students. relay by every participants video encouragements by Seiji ASAHARA, who is a Olympic bronze medalist and Dai TAMESUE, who is a bronze medalist on World Championships in Athletics.</td>
</tr>
<tr>
<td>2</td>
<td>Technical instruction to every students by making 1 group per 5 to 6 students. (indoors because of rain)</td>
</tr>
<tr>
<td>3</td>
<td>Technical instruction to every students by making 1 group per 3 students relay match by high school students</td>
</tr>
<tr>
<td>4</td>
<td>To give instruction on practical skills by a 800m japanese record holder</td>
</tr>
<tr>
<td>5</td>
<td>Technical instruction by japanese record holders and representatives</td>
</tr>
</tbody>
</table>

2.4.2 Qualitative analysis

We coded and analysed the description thematically. This process was then repeated for further classification, resulting in the establishment of categories and subcategories.

One of the authors of this paper, who has a background in nursing and qualitative research, led this analysis with two members of the research team who have thorough knowledge of sports and management.

Once completed, cross-checking and cross-validation of each investigator’s analysis was conducted, with triangular consensus required for the concluded themes (i.e. by all members of the research group).

2.5 Ethics

Contents of the study was first explained to the participants in a written form at their school, and then those who were willing to participate had to submit an informed consent signed by their parents and themselves before they joined the program. We also obtained the informed consent of the president of Soma high school. All the athletes participated in the study gave a verbal consent to use and display their personally identifying information in our study. The ethical review board of Waseda University also approved the study. (Study code: 2011–108 (1)).

All the athletes participated in the study have checked the final version of this article, and gave permission/consent in a written form for using and
3.2 Objective evaluation of students’ event records

The event records of students prior to and after A and B competed in the London 2012 Summer Olympic Games.
Subjective evaluations by high school students


3.3 Subjective evaluations by high school students

The students’ perceived physical competence, participation are displayed in Table 3. Between May and September 2011, 10 students set new records; the short distance specialists set new records by 0.33–1.58 s, the middle distance specialists by 1.53–13.69 s, and the long distance specialists by 1:16.5–24.0 s; four students set new event records between May 2011 and May 2012 and between August 2011 and May 2012.

### Table 4 Subjective evaluations by high school students: Median (Range)

<table>
<thead>
<tr>
<th>Category</th>
<th>September (n = 13)</th>
<th>October (n = 9)</th>
<th>November (n = 12)</th>
<th>December (n = 12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Physical Competence</td>
<td>47 (39–57)</td>
<td>53 (41–58)</td>
<td>51 (38–59)</td>
<td>50 (37–57)</td>
</tr>
<tr>
<td>Perception of Organizational Changes in Varsity Sports</td>
<td>11 (10–12)</td>
<td>11 (9–12)</td>
<td>11 (9–12)</td>
<td>NS</td>
</tr>
</tbody>
</table>

* Perceived physical competence was evaluated on a scale of 60
* Self-efficacy was evaluated on a scale of 28
* Perception of organizational changes in varsity sports was evaluated on a scale of 12

### Table 5 Free response workshop evaluations and self-assessment of athletic mentality changes by the students

<table>
<thead>
<tr>
<th>Categories</th>
<th>Sub-Categories</th>
<th>Responses</th>
<th>(Date and Recurrence of Response)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional Response</td>
<td>Gratitude</td>
<td>Thankful</td>
<td>(September: 4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Appreciation towards visiting athletes</td>
<td>(September: 3, December: 3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Request</td>
<td>(October: 2, November: 3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dissatisfaction</td>
<td>(December: 1)</td>
</tr>
<tr>
<td>Motivation</td>
<td>Resolution</td>
<td>Motivated to practice daily</td>
<td>(September: 5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>New goals</td>
<td>(September: 5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>To qualify for Tohoku Prefecture competitions</td>
<td>(October: 1, November: 5, December: 4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Qualify for National Competitions</td>
<td>(December: 2)</td>
</tr>
<tr>
<td>Content of Instruction</td>
<td>Satisfaction</td>
<td>The athletes answered questions</td>
<td>(September: 8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in a straightforward manner</td>
<td>(September: 8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improvement in performance</td>
<td>(September: 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lessons were enjoyable</td>
<td>(September: 3, October: 3, November: 5, December: 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Learning from professional athletes</td>
<td>(October: 4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Discovered new methods for practice</td>
<td>(November: 4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coached by members of the Japanese national team</td>
<td>(November: 3, December: 2)</td>
</tr>
</tbody>
</table>

* ( ) Characters enclosed in brackets are date and recurrence of response
self-efficacy, and perception of organizational changes are shown in Table 4. There were no significant differences in these variables through the workshops.

The results of the free response questionnaires used to evaluate the quality of the workshop and the perceived mentality changes of students are presented in Table 5. In September 2011, the students mainly responded with thankfulness and appreciation, which were placed under the category “emotional response”. In October and December 2011, they reported requests for the athletes and dissatisfaction from the lessons. Thus, for clarity and organization, “emotional response” was subcategorized into “gratitude”, “request”, and “dissatisfaction”. Through frequent participation, students began seeing athletic improvements and developed new goals; these underlying sensations were later classified as “resolution”, under the category “motivation”. By acquiring knowledge from professional athletes, the students discovered new methods for practice and obtained considerable enjoyment from the lessons, which were classified as “satisfaction”, under the category “content of instruction”.

3.4 Subjective evaluations by athletes

Serial changes in subjective evaluation by the athletes are shown in Table 6. In September 2011, the athletes rated their relationships with the students and faculty members of Soma High School to be distant. However, as the months passed, they reported having closer relationships with the students and faculty members.

From October to December 2011, five athletes noticed increases in smiles among the students. Between October and November 2011, four reported...
having personal conversations with faculty members and another three perceived a heavy reliance from the faculty members after being consulted on how to improve coaching techniques.

We also found that supporting an important social cause resulted in the athletes considerably reflecting on their personal and social responsibilities and their roles as coaches.

4. Discussion

We examined the change of the participating students and athletes by continuous sports lessons with objective–subjective dualism through the examination of both physical and mental effects.

As indicated by the results, all of the 11 students who participated in this workshop set new personal event records; middle–long distance specialists broke their previous records by 3.34–54.30 s, and short distance specialists set new records by 0.33–1.58 s. It should be noted that these are displays of significant athletic improvement, since Japanese varsity athletes of the same age group usually improve their times in 50 m and 1500 m events by only 0.006 s and 10 s respectively. These findings thus suggest several factors that could contribute to this rapid improvement in performance, namely, coaching, background, and support duration.

Prior to these lessons, the students were coached by faculty members with little knowledge of athletics; the workshops allowed them to be coached by professional athletes who have achieved success in sports. These athletes are believed to have been better at articulating their understanding of athletics, which accelerated the athletic development of the students.

An underlying factor for athletic development is athletic ability. For instance, participants of our study were student–athletes of university preparatory schools who could qualify for regional competitions at best. Thus, compared to students of sports-oriented schools, these students had a greater potential for physical improvement. The number of the students was limited, which also had an effect on the result.

Duration of support could also have contributed to successful athletic development. The conventional disaster–relief practice by professional athletes is a one-day visit to a disaster-stricken region to host a daylong workshop. In contrast, the present study was designed for athletes to make a long-term visit by hosting sports lessons for 6 months. The long duration was beneficial because the athletes had a sufficient amount of time to analyze technical problems and insufficiencies in each student and formulate quality advice. Furthermore, they were able to construct and utilize new practices that would most favourably enhance the students’ performance.

The subjective evaluations also revealed that the students and athletes have developed closer interpersonal relationships over this period. Moreover, the students have developed a friendly rivalry with these athletes. By having an elite athlete in their midst, the students were inspired to establish internal motives and a desire to succeed. They also transgressed from simply expressing gratitude to truly appreciating the company of these athletes.

Interestingly, the athletes also perceived enhancements in their physical and psychological state. For instance, they felt that their sense of empathy was augmented by developing a rapport with victims of a natural disaster. In addition, this workshop led to the athletes reflecting heavily on their social and personal responsibilities and the importance of contributing to a social matter. Being heavily relied on for support from the students and faculty members, the athletes’ self-confidence increased as well, which could lead to further success in sports.

The students’ assessments indicated no changes in the subjective variables of perceived physical competence and self-efficacy. One explanation could be that the difficulty of the practices enforced by the athletes led to the students not perceiving
changes in their physical competence. As the students progressed, the athletes matched this progress by increasing the demand and difficulty of the next practice. Consequently, the students felt little to no self-achievement and reported no changes in their perceived physical competence and self-efficacy.

Although the quantitative data indicated no changes in self-efficacy, the qualitative data suggested otherwise. For instance, many students indicated an establishment of new motives and resolutions, which implied enhanced self-efficacy. This may due to the lessons; however, a detailed investigation was not conducted to clarify this discrepancy.

It is important to note that the variables used for self-assessment are similar to those used for PTG (positive changes experienced as a result of struggle with major loss or trauma). Studies on PTG have mainly investigated the impact of devastating circumstances, such as the physical and mental changes of traffic accident victims before and after recovery and the psychological changes observed in cancer patients after cancer care by measuring variables such as “appreciation towards life” and “new possibilities”. In our study, the students indicated positive changes in their self-motivation, similar to those who have experienced PTG.

There are several limitations to this study. One limitation is that this study only included victims of the Tohoku Earthquake and their current social and financial circumstances are likely to have affected our findings. The other limitation is that this research was held in a resource-limited setting due to the after-effects of the earthquake. For instance, an investigation on post-traumatic stress disorder (PTSD) in the students could not be conducted because conventional methods of PTSD evaluation place people under study in a highly stressful environment. As these students have recently suffered from a critical life-changing experience, the faculty of Soma High School requested an alternative PTSD evaluation which is designed to place people in a less stressful setting. As a result, a portion of this research was completed through trial and error and unexpected bias may exist in our data. Therefore, future studies should make adjustments to enhance the quality of research design and implementation.

In conclusion, our study has provided evidence to support the hypothesis that continuous sports lessons by professional athletes in disaster stricken regions could result in fruitful outcomes; the students successfully progressed in sports and developed internal motives while the athletes perceived enhancements in their physical and psychological states.

This result can be generalized to every high school students, not only restricted to students in disaster areas.

Conflict of interest

The authors declare no conflict of interest.

Authors’ contributions

TN, YK, TH, and MK and designed this research. TN, YK, and SH wrote the paper, analysed, and managed the data while AH and TM carried out data collection and reviewed the paper. TH and MK then reviewed the paper and gave final approval. All authors approved the final version of the report for submission.

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References


