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Case Study on Tele-Exercise for Calisthenics Using Consumer Internet Devices and a Software

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Abstract. The present study attempted calisthenics via tele-exercise using the Internet and ascertained the possibility of and perspectives regarding tele-exercise from the reactions of participants who attended the exercise class. Twenty-one participants attended a calisthenics class conducted by an instructor 9 km away from the room in which the participants were exercising. The tele-exercise was developed utilizing consumer Internet devices and a software (Skype™) as a real-time and interactive communication apparatus. The result indicated that tele-exercise was almost sufficient for the participants to understand the practical calisthenics skills. However, the participants' uneasiness due to the instructor not being present was also demonstrated.

Keywords. tele-exercise, calisthenics, Internet

1. Introduction

Moderate physical exercise is not only widely recognized as an essential aspect of a healthy lifestyle but is also valued from the viewpoint of preventive care. The effectiveness of aerobic exercise and resistance training for health is experimentally established [1], and physical activities based on this knowledge are practiced both in the home and at exercise facilities. Therefore, experts who can provide methods for and information on appropriate exercise prescription are required, as they may contribute to the health of local inhabitants.

However, there is often a financial limit and a speculative aspect to supporting the physical activity of several people while the number of available experts is inadequate. In today's aging society, the demand for exercise instruction to maintain health progressively increases, and the development of a new instruction management system may be expected.

The use of a computer software to assist exercise instruction has been promoted in physical training and physical education [5]. Many studies have reported that the effects of learning or recognition for a target movement would be observed when a participant independently used the software and/or an instructor utilized it for the participant. [2,4,6] Such a software is regarded as instructional material in multimedia education, but it does not substitute for the instructor.

On the other hand, because real-time and interactive audiovisual communication, such as in 'telemedicine' technology, is easily achieved over the Internet, the instruction of practical exercise skills using tele-exercise have recently been undertaken [3,7]. Especially, Wu (2006) reported that the balance of elderly individuals improved by tele-exercise for Tai Chi Chuan [7]. Thus, such an audiovisual communication strategy may facilitate the instruction of practical skills even if the instructor is at a remote location. We investigated the reaction of the participants who attend a calisthenics class using tele-exercise. Simultaneously, we assessed whether tele-exercise could be implemented using the real-time communication software Skype™, a widely known free consumer application.

Therefore, this study attempted calisthenics via tele-exercise using the Internet and assessed the possibility of and the perspective on tele-exercise on the basis of the reactions of participants who attended the exercise class..

2. Materials and Methods

2.1. Internet devices and a software

In this study, two rooms were linked using Internet devices and a software. In one room, a female instructor demonstrated practical calisthenics skills, while in the other room, participants performed the demonstrated exercises while watching the instructor on a video monitor. The linear distance between the rooms was approximately 9 km. An ADSL line was used for the instructor's room (actual download speed: 2.2 Mbps) and an FTTH line was used for the participants' room (actual download speed: 3.2 Mbps). These lines established the consumer and commercial Internet connection environment. To connect to the Internet, a personal computer (PC) and a web camera with a microphone were set up on each side, and Skype™ (Version 2.5, Skype Technologies SA, Luxembourg) was installed on each PC. This enabled real-time peer-to-peer audiovisual communication. The PC's video signal was converted into NTSC format using a PC-video converter (I-O data, TVC-XGA2, Japan) and was output to a 29-inch video monitor. The voice signal of the PC was output through a speaker accompanying the monitor. Thus, the instructor's movement in the video was downloaded onto the PC in the participants' room and viewed on the monitor. Similarly, the participants' movement in the video was visible in the instructor's room. Furthermore, the instructor's voice was transmitted using a microphone attached to a headset, and the signal was downloaded by the PC in the participants' room and output through the speaker accompanying the video monitor. Conversely, the participants' voices were also transmitted and downloaded to the instructor's headphones (Figure 1).

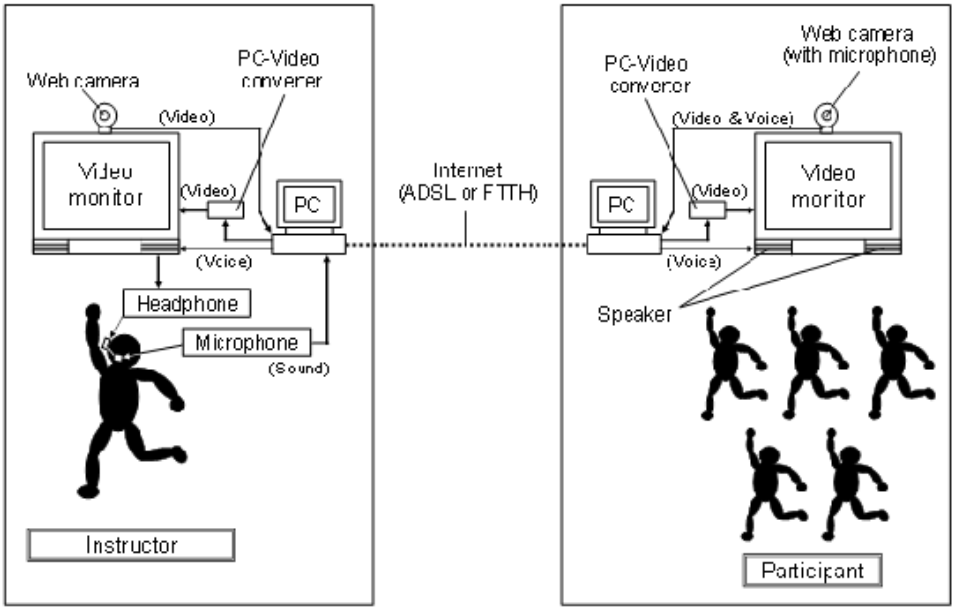

Figure 1. Schematic diagram of the tele-exercise in this study

2.2. Tele-exercise for calisthenics

The calisthenics class in this study was prepared in a community sports centre (Fukui Kenkoh-no-mori, Fukui, Japan). The class was named 'Easy Exercise Class' and was announced prior to this study. It was conducted three times, and 21 participants (16 females and 5 males) attended the class. Most of them (18/21) were middle-aged or elderly individuals (40–69 years old), and the class included nine participants over 60 years of age. The calisthenics consisted of a combination of warm-ups including stretching, six types of main exercise (21 min) and cool-down, for a total of approximately 30 min. Table 1 illustrates the exercise types as well as the target muscles and time required for each exercise.

Table 1. Exercise type as well as the target muscles and time required for each exercise in calisthenics class

Type	Target muscles	Time
Squat	*Quadriceps femoris* muscle and hamstrings	3 min
Calf-raise	*Triceps surae* muscle	3 min
Push up	Greater pectoral muscle	3 min
Balance pause	*Gluteus maximus* muscle	6 min
Sit-ups	Abdominal muscles	3 min
Back extension	Back extensor muscles	3 min

2.3. Questionnaire survey

A questionnaire survey was administered immediately after the instruction and obtained direct answers from the participants. The questionnaire is exhibited in Table 2. Answers to the questionnaire were regarded as the reaction of the participants to the tele-exercise in this study.

Table 2. Questionnaire to investigate the perspectives on tele-exercise for calisthenics.

Q1. Was tele-exercise sufficient to understand the practical skills?
A1: sufficient
A2: almost sufficient
A3: unsure
A4: not quite sufficient
A5: insufficient

Q2. What, according to you, are the negative aspects of the tele-exercise?
(multiple choice allowed)
A1: I'm not satisfied with the instructor not being present.
A2: I'm scared because the instructor cannot assist in the case of an emergency.
A3: I'm unsure whether the instructor can really confirm the accuracy of my movement.
A4: There is audiovisual disturbance (hard to see, difficult to hear and incomprehensible).

Q3. What types of disturbance did you experience during the tele-exercise?
(only for participants who responded A4 in Q2; descriptive answer)

Q4. Impression of tele-exercise (descriptive answer).

3. Results and Discussion

The devices and software used in this study as well as images of the tele-exercise are displayed in Photos 1–4. In this study, the time delay that affected both audio and video in both rooms during the tele-exercise session was not acceptable. Generally, when using conventional software for computer-assisted instruction (CAI) relating to physical education, sports and fitness exercise, the participant (or learner) watches a movie clip of the instructor's demonstration and imitates the practical skills [2, 4, 6] In contrast, the tele-exercise enables an instructor to monitor the participant, unlike CAI software, and to teach practical skills while he/she confirms the accuracy of the participants' movement. Consequently, it was observed that the instructor communicated with the participants, and the participants imitated the instructor's movement in all tele-exercise classes. This was in accordance with the predicted traits of the relationship between an instructor and participants.

Photo 1. Viewing an instructor using Internet devices and a software

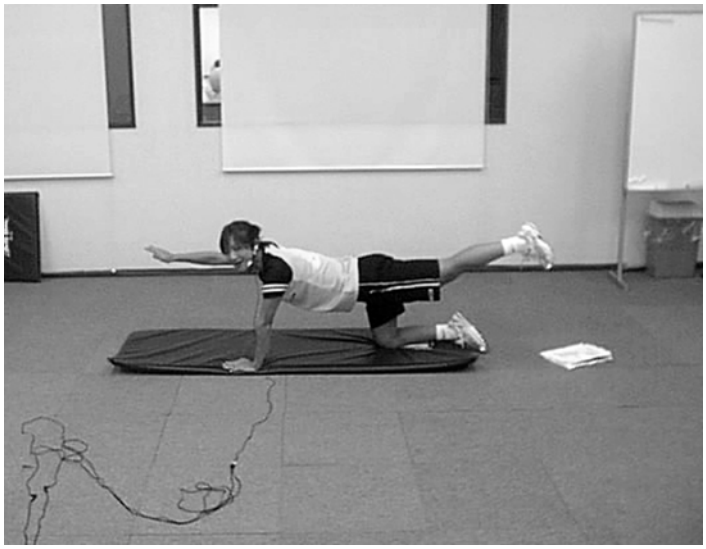

Photo 2. Instruction (instructor's room, balance pause)

Photo 3. Participants exercising (participant's room, stretching)

Photo 4. Participants exercising (participant's room, sit-ups)

The results of the questionnaire survey suggested that more than 80% of the participants responded 'sufficient' and 'almost sufficient' to the question regarding the efficiency of tele-exercise for understanding

the practical skills (Q1) (17/21, Figure 2). It was thus considered that the understanding of practical skills was almost accomplished through tele-exercise. Regarding the negative aspects of tele-exercise (Q2), the highest number of responses (10/21) indicated that 'I am unsure whether the instructor can really confirm the accuracy of my movement' (A3), as shown in Table 3. The second most frequent response to Q2 was A1 ('I'm not satisfied with the instructor not being present' (Figure 3). This answer might be related to A3, because the highlighted issue in both responses was the same, that of the instructor not being present. In addition, several answers noted that the audio disturbance was detrimental to the tele-exercise experience (answer in Q3, Table 3). Participants were regarded as more susceptible to the disturbance in the audio than to that in the video. Finally, impressions of the tele-exercise (Q4) are reflected in Table 4; there was a descriptive answer concerning ways in which tele-exercise may spread across homes.

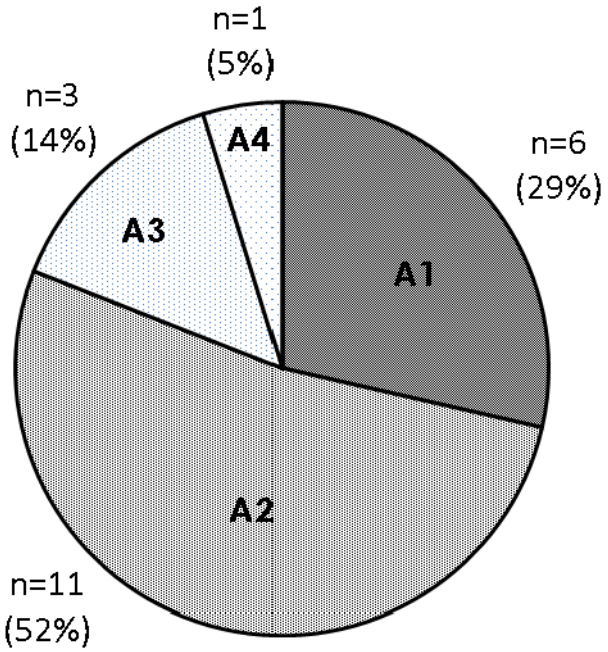

Figure 2. Number and ratio of the answers in Q1. No participant answered A5.

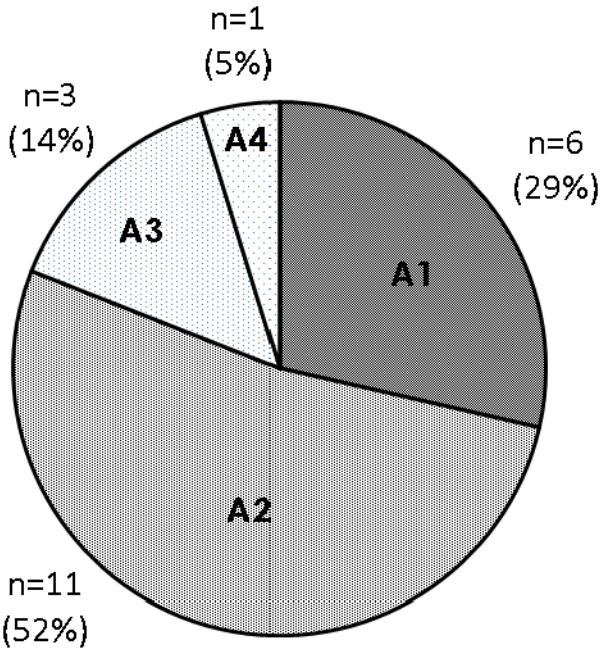

Figure. 3. Number and ratio of the answers in Q2.

Table 3. Descriptive answers regarding the disturbance experienced by participants during the tele-exercise (Q3)

Descriptive answer	Number
Instructor's voice breaks off	4
Hard to hear instructor's voice	2
Noisy	1
Incomprehensible explanation of practical skills	1

Table 4. Descriptive answers regarding the impression of tele-exercise (Q4)

Descriptive answer	Number
Enjoyable	2
Tele-exercise may spread across homes	1
The audio and video should be smoother	1

In conclusion, this study determined that tele-exercise was almost sufficient to understand practical calisthenics skills. However, the study also revealed participants' uneasiness due to the instructor not being present.

4. References

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