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Verification of the Effectiveness of Blended Learning in Teaching Performance Skills for Simultaneous Singing and Piano Playing

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1. Introduction

While difficulty in acquiring a skill in simultaneous singing and piano playing is attributable to both instructors and students, instructors have been taking a variety of approaches to remedy the situation at least in the piano playing skill. One hardware-based approach to improving teaching has been to develop a system that is installed in a music laboratory (ML) and enables the instructor to check the level of skill of each student even in a group lesson. A music laboratory is usually equipped with some tens of keyboards. In an ML, the instructor can listen to the piano playing of individual students, and give private advice to each student. As such, an ML was considered a pioneering educational system for group training of music. MLs have been used for the training of not only piano playing but also elementary music theory, including harmony, which can be tried out using keyboards. It was thought that an ML, in which each keyboard is used by one or two students, was effective in teaching elementary music theory and piano playing because the instruction through an ML can efficiently substitute for private lessons in these areas. However, the use of ML equipment is so complicated that it imposes a considerable burden on the instructor. Also, since studentsĄf performance can be checked only during the class hour, an ML is not practical at all for classes with a hundred or so students. Consequently, there is still considerable reliance on face-to-face training when it comes to the teaching of music.

Research efforts to improve teaching using software have mainly focused on a combination of two approaches: the development of appropriate computer software and the improvement of the teaching method itself. Approaches that involve the development of computer software include the following. In 1990, (Dannenberg et al., 1990) developed Piano Tutor, a computer-based piano tutoring system for beginner-level piano students. In 2000, (Hosaka, 2001) used audio-visual material. In 2001, (Matsumoto, 2001) used piano instruction material for computer-assisted instruction (CAI). In 2005, (Suzuki, 2005) developed Net-CAPIS, which introduced a connection to a network in a music laboratory (ML).

Attempts to improve teaching methods include the use of practice record cards ((Imaizumi, 2004)) and observation of others ((Nakajima, 2002)) . (Ogura, 2006) introduced blended learning using MIDI audio sources.

In spite of the various initiatives mentioned, the method most often used for teaching the still important subject of simultaneous singing and piano playing is one that uses self-learning records and the observation of others in classroom lessons, including face-to-face group lessons. This method is used not only in Japan but also in many other countries, such as China and Germany. There have been many practice-based studies on the advantages and disadvantages of group lessons as a means of teaching a musical performance skill. (Li & Kenshiro, 2003) reported on the status of group piano lessons given in teacher training colleges in China. They undertook a questionnaire survey with 169 students in teacher training colleges in China, and found that students preferred individual lessons to group lessons in learning piano playing. The reasons given were that (1) individual lessons provide detailed instructions, and (2) students can learn a wider variety of subjects more efficiently. Studies in Japan have been inconclusive about the advantages of group lessons. (Furukawa, 2003) recognized the advantages of group lessons but indicated that ultimately it was necessary to rely on individual lessons. (Nakagawa, 2007) suggested that group lessons have positive effects on students.

The above studies indicate that is it difficult to entirely eliminate some form of group lessons for the teaching of simultaneous singing and piano playing. The authors have considered that it may be possible to make group lessons as effective as individual lessons in improving students' skills by combining them with other methods or by modifying the way they are given.

In this chapter, we report on a training method in which students not only took group lessons (hereafter referred to as "face-to-face" training) but also were required to view e-learning material and to submit videos of their performance. We study the effects of the e-learning material by examining how the students' performance and perception changed after viewing the e-learning material. In addition, we indicate the limitations of non-face-to-face training and the need to combine such training with face-to-face training in what we call "blended" training.

2. Practice environment

We applied our method to the course "Music for Children I" at the Faculty of Developmental Education in Kyoto Women's College. The course lasts from April to July. This paper uses data for the courses conducted in 2006 and 2009. In both years, the number of students who took mid-term or final exams in piano-playing and singing was 102 for 2006 and 105 for 2009. Figure1 shows the teaching model used in the course, which consists of (1) singing, (2) chord progression, and (3) simultaneous singing and piano playing. Each lesson lasted for 180 minutes. For the first half of the four-month course, one lesson consisted of 90 minutes of singing, 45 minutes of group lesson and 45 minutes of self-learning (individual performance practice). In the latter half of the course, one lesson consisted of 60 minutes of singing, 60 minutes of group lesson, and 60 minutes of lecture on chord progression. A midterm exam and a final exam were given at the end of May and in the middle of July respectively to examine performance skills for simultaneous singing and piano playing. Since 2006, KS20 (hereinafter referred to as "Kenshukun") from Company Fujifilm, has been used to enable students to submit videos of their own performance before and after performance exams, as was proposed by (Yokoyama et al., 2004) (There have been many papers reporting on the use of Kenshukun, such as (Nakahira et al., 2009)). Kenshukun is a video recording and playing device, and can be used for the creation of video content. The video format used is MPEG2. The filename of the video file in which the student recorded her performance can be printed as a bar code on paper. The student can review her performance right after she has recorded it by having the bar code of her file read by Kenshukun. For this experiment, endoscopic

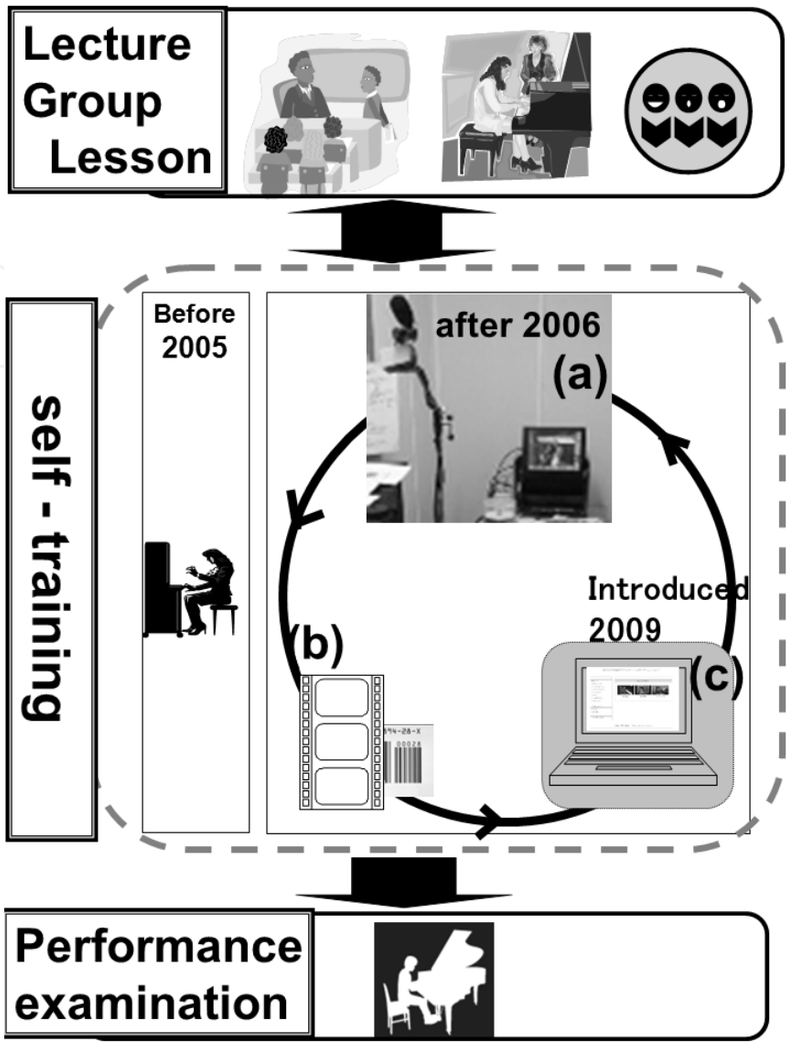

Fig. 1. Class Design

technology was adopted in the camera so that the position of its lens can be extended by 3.5 m to take a video of the student's facial expressions and hand movements on the keyboard of an upright piano from above. The students submitted paper with the bar code printed on it instead of actually submitting a video. Instructors can have a bar code read and in this way play the corresponding video.

The e-learning material (entitled "e-learning course on piano performance for teachers and pre-school teachers", developed by (Nakahira et al., 2008)) consists of four parts: (1) model performance of simultaneous singing and piano playing, (2) model performance of singing, (3) musical scores with annotations, and (4) FAQs for better singing. Part (1) contains videos of model performances of the seven carefully selected songs. Figure 2 shows the sample of e-Learning contents.

The model performance of each song is presented in the form of three videos, showing, respectively, finger movements, facial expressions, and the overall appearance. Part (2) contains videos of model singing. Additionally, it also provides short advice on important points in videos, in text and on scores. Part (3) contains PDF files of musical scores

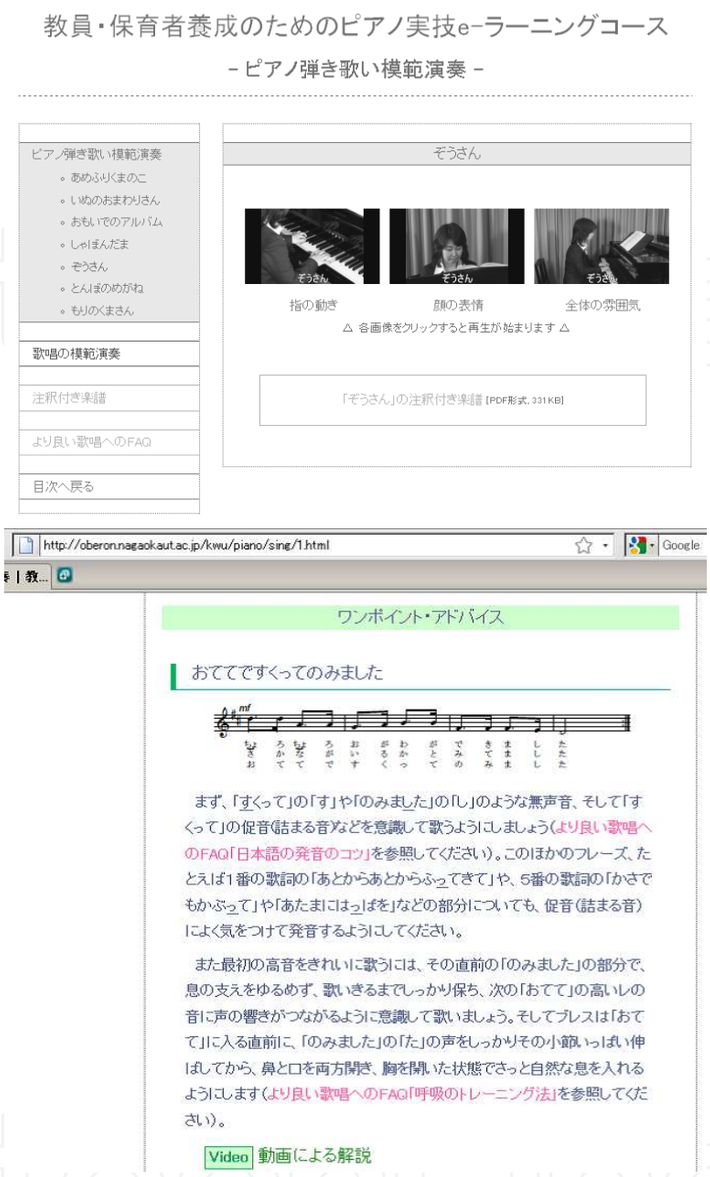

Fig. 2. Contents example of piano skill e-Learning course for pre-teacher course students. (upper side)Model playing. (lower side)Guidance of singing.

with annotations. The information in these files is extraordinarily rich in detail for scores designed for teachers and pre-school teachers. Part (4) contains text with photos and singing performance videos both of which explain how to ensure good vocalization. The length of time for which each student viewed the e-learning material was recorded as part of his/her learning activity log. In this chapter, we analyze the performance videos and reports submitted before and after the viewing of the e-learning material by the top 15 students ranked in terms of the length of viewing time.

3. Analysis

S	*LH*	*IP*	*CS*
A	15	*B*	Tempo became correct. Opened the mouth more widely and tried to sing more expressively. Looked more relaxed. Improvement in singing was greater than in piano playing.
B	10	*B*	Tempo became correct. As a whole, looked anxious to sing carefully.
C	1	*G*	While looking somewhat anxious to open the mouth widely, overall there was no significant improvement.
D	9	*G*	Although the problem of not remembering lyrics was solved, overall there was no significant improvement.
E	7	*B*	Voice became louder although expression was still poor.
F	16*	*B*	Although voice became clearer and more articulate, singing became childish. Played the piano more carefully.
G	10	*B*	Made improvements in the expression of glottal stops (a feature of the Japanese language), in distinction between loud and soft parts, and in expression of the words, “Annakoto Konnakoto."
H	0*	*A*	Made a remarkable improvement in all aspects, particularly in singing. Despite the steady improvement, fluctuations in tempo were not corrected.
I	7	*G*	The attempt to play the endings of phrases carefully backfired, causing fingers to move less smoothly. There was no significant improvement.
J	4	*B*	While voice was still too soft, made an improvement overall.
K	13	*A*	Learned a great deal from the e-learning material, and made a remarkable improvement. However, expression was too strong, which caused tempo to fluctuate. Looked anxious to mimic the model performance of simultaneous singing and piano playing. However, excessive eagerness to play well caused the body to sway back and forth. Singing reflected good understanding of the lyrics. Showed improved balance in volume between piano and singing.
L	*	*B*	Made improvements, particularly in singing. Awkward movements of the left hand on the piano were not corrected.
M	7	*B*	Looked anxious to sing expressively and to make a clear distinction between loud and soft parts.

Table 1. Examples of changes in quality of performance after viewing the e-learning material for more than 30 minutes. The index *S* means “students". The index *LH* means Learning History(total years). The students with (*) in the learning history column took the course, “Introduction to Piano", and private lessons when they were first year students. Student H has carrire for studying piano before entrans to the University. Student L has no data. The index *IP* means improvement, which the rank *A* is excellent, rank *B* is good, rank *G* is newtral. The index *CS* means changes in the second recording compared with the first recording(students viewed the e-learning between the two recordings).

N 13 *B* Sang expressively. Tempo improved.
O 3 *G* Although there was some improvement in breathing in some parts of singing, still had breathing problems elsewhere.

3.1 Change after viewing the e-learning material

Table 1 summarizes changes that occurred in the case of the 15 students after viewing the e-learning material. Two students achieved a remarkable improvement, and 9 showed some improvement while the remaining 4 made little improvement. Generally, students made more improvement in singing than in piano playing. The learning history column shows the number of years for which the student had learned piano playing. The students with (*) in the learning history column took the course, “Introduction to Piano", and private lessons when they were first year students.

The characteristics of the two students who made a remarkable improvement are as follows. Student H was a beginner in the piano. Although she mastered almost everything she could learn from the e-learning material, she seemed to be lost about how to practice in the future. Student K was an advanced learner of the piano. Watching the model performance enabled her to take a new look at her performance. As a result, she made remarkable progress in areas where she was able to build an image of how the performance should be. However, there were also areas where she was able to build an ideal image but failed to express it. Both students tended to be insensitive to fluctuations in tempo(Specifically, they gradually increased tempo).

3.2 Changes in scores from the mid-term exam to the final exam

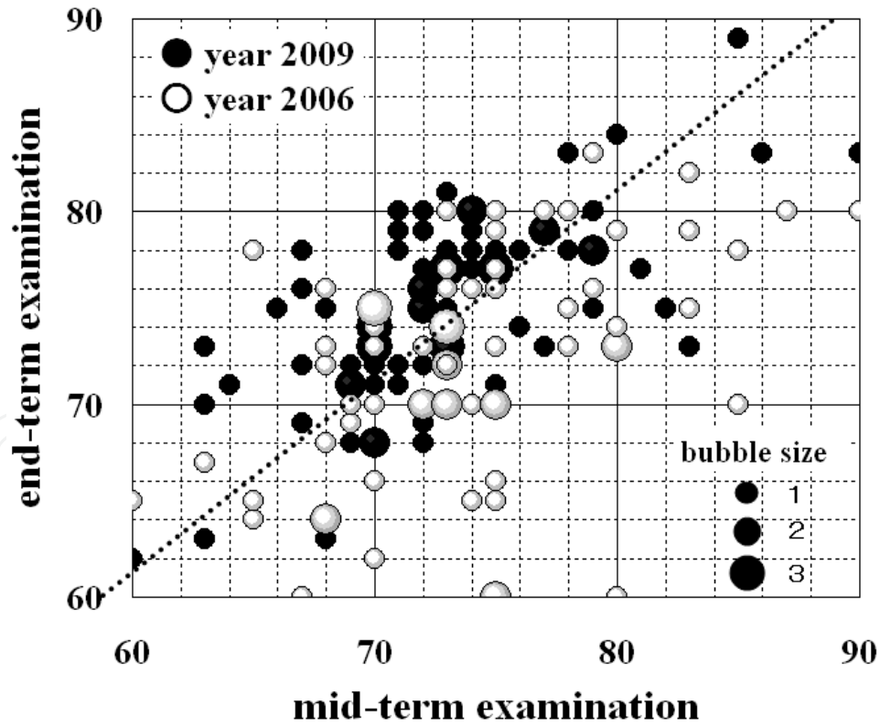

Fig. 3. distribution of s_m and s_f. The bubble size shows the number of person who got the score pair.

Through the experience, we show the change of the students’ skill between mid-term examination and the end-term examination ((Nakahira et al., 2010a;b)). To examine how

		Length of time spent viewing the e-learning material		
		0	up to 30 min	more than 30 min
number of students		34	53	18
mid-exam	$\bar{SC}$	72.26	73.08	73.78
	σ	6.21	4.20	7.32
end-exam	$\bar{SC}$	70.32	74.85	75.39
	σ	18.56	4.07	5.76
Percentage of those whose score went up or down	up	53%	68%	67%
	down	29%	21%	28%

Table 2. Relationship between the results of the mid-term and final exams and the length of time of viewing the e-learning material. $\bar{SC}$ means average score.

individuals fared, Figure 3 shows a two-dimensional distribution of the scores of the mid-term and final exams of individual students. Let s_m be the score of the mid-term exam, and s_f the score of the final exam. Define δ as $s_f - s_m$. The horizontal axis in the figure shows δ while the vertical axis shows the fraction of students for each value of δ. The horizontal axis shows s_m while the vertical axis shown s_f. Therefore, the coordinate of a student can be expressed as (s_m, s_f). The size of each bubble indicates the number of students on that coordinate. The dotted line shows $s_m = s_f$. If a bubble is on the upper left side of the line, its δ is positive. The farther away from the line a bubble is, the greater the value of its δ. Figure 3 clearly shows that, from 2006 to 2009, the average positions of the bubbles shifted to the upper left side of the line. These data indicate that the change in the teaching model from 2006 to 2009 resulted in a positive improvement in students' performance skills.

Table 2 shows the changes in scores from the mid-term exam to the final exam. Students could be classified into three groups: a group that did not view the e-learning material, a group that viewed the material for up to 30 minutes, and a group that viewed the material for more than 30 minutes.

In the mid-term exam, there was no significant difference between the three groups with regard to the average score. In the final exam, the difference was more pronounced. The group that had not viewed the e-learning material did not show any improvement in the average score in the final exam, and its standard deviation, σ, increased. The groups that had viewed the material achieved average scores which were 4 or 5 percentage points higher, and which had smaller standard deviations, than the group that did not view the material at all. With regard to individual results, a higher percentage of the students in the group that did not view the e-learning material saw no change in their scores between the mid-term and final exams than the percentage of those in the other two groups.

Considering the fact that there was no significant difference in the average score in the mid-term exam between the three groups, that almost all students submitted videos of their performance at least once, i.e., they had the opportunity to review their own performance by watching their videos, and that there was a pronounced difference between the three groups in the average score and the standard deviation, σ, it can be concluded that it was useful for students to view the e-learning material before they submitted their second performance videos.

	MPSP	*MPS*	*MS*	*FAQ*
tempo	√		√	
articulation	√		√	
image of the music	√			
facial expression	√			
posture in playing	√	√		
dynamic	√	√		
movement of finger			√	
balance of the volume between singing and playing	√			
length of note or rest	√			
balance of the volume between each hands plaing	√			
pronunciation		√		√
vocalism		√		√
the mean of lyric		√		
timing of the breath		√		
aware of missing point			√	
consciousness to breath				√
recognize their own voice				√

Table 3. The items which evaluate usuful by students. *MPSP*, *MPS*, *MS*, *FAQ* means each e-Learning contents title whether *MPSP* means model performance of simultaneous singing and piano playing, *MPS* means model performance of singing, *MS* menas musical scores with annotations, *FAQ* means FAQs for better singing.

4. Discussion

4.1 Effects of viewing the e-learning material

The reports submitted by the students indicate that those students who viewed the e-learning material for a long time became aware of many important points and were anxious to learn. In their reports, the 15 students whose reports were analyzed identified 17 points that they found useful in the e-learning material, such as dynamics, articulation, facial expression, performance posture, balance in volume between the piano and singing, tempo of each song, and vocalization. Table 3 shows the items which students feels useful.

In particular, they found the model performance of simultaneous singing and piano playing and that of singing especially useful. The comparison of performances recorded on videos before and after the viewing of the e-learning material shows that 11 out of 15 students made progress in performance, particularly in singing, in spite of the fact that they had not received any face-to-face lessons between the two recordings.

The above findings together with the results of the mid-term and final performance exams indicate that the viewing of the e-learning material helped beginners to build basic skills and advanced learners to acquire a higher level of skills in expression. As a whole, the material tended to be useful for improving singing. It is certain that providing appropriate e-learning material to enable students to learn singing theory and to enable a model performance to be imprinted on their memory, and requiring students to submit reports and videos of their performance are very useful in supporting students in self-training. In particular, the very fact that students with no piano playing background before entering the university were able to acquire almost all the basic skills in simultaneous singing and piano playing indicates that the use of e-learning material affords the possibility that it can make up for a shortage of time for face-to-face lessons.

4.2 Needs of blending non-face-to-face training with face-to-face training

While including the viewing of the e-learning material in the training of simultaneous singing and piano playing helped students improve many skills, there were certain skills that could not be improved just by viewing the e-learning material. Such skills include controlling the tempo of each song, articulation and vocalization, although students reported that the e-learning material did help them improve these skills. Specifically, the e-learning material was not helpful in solving the problems of fluctuations in tempo during performance, pronunciation of the nasal sonant in Japanese, placing of breaths, and excessive staccato in piano playing. In particular, students showed little improvement in solving the problem of fluctuations in tempo in spite of the fact the instructor clearly pointed out this problem by playing the videos of students' performances. Improvement in these skills can be better achieved through direct advice given during face-to-face lessons. While some students made a good improvement, some failed to do so even when they had viewed the e-learning material for the same length of time as the others. Differences in the amount of practice after the viewing may partially explain the difference, but it is essential that students develop the ability to perceive differences between their own performance and the model performance, and to apply what they have learned from the model performance to their own performance. Therefore, in face-to-face lessons, the instructor needs to train students in how to learn from the e-learning material.

5. Conclusion

In this paper, we introduced a method of requiring students to view e-learning material and to submit videos of their performance. In this paper, we evaluate how this method improves students' performance skills, based on the length of time the students spent in viewing the e-learning material, the reports submitted by the students, the videos of the students' performance taken in the course of their regular practice, and the results of their mid-term and final performance exams. It is shown that (1) the combination of the viewing of the e-learning material and the submission of performance videos, which are both non-face-to-face training, encourages the students to undertake self-training and can considerably improve their performance skills, and that (2) it is necessary to provide face-to-face training for certain skills that cannot be improved through non-face-to-face training.

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Biometric Systems, Design and Applications

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Biometric authentication has been widely used for access control and security systems over the past few years. The purpose of this book is to provide the readers with life cycle of different biometric authentication systems from their design and development to qualification and final application. The major systems discussed in this book include fingerprint identification, face recognition, iris segmentation and classification, signature verification and other miscellaneous systems which describe management policies of biometrics, reliability measures, pressure based typing and signature verification, bio-chemical systems and behavioral characteristics. In summary, this book provides the students and the researchers with different approaches to develop biometric authentication systems and at the same time includes state-of-the-art approaches in their design and development. The approaches have been thoroughly tested on standard databases and in real world applications.

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