

# Development of a Student Centered Educational Design for Piano Playing and Singing Skills

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**Abstract.** One of challenging subjects for education is construction of skill transfer environment. As an effort to pursue this challenge, we have engaged in development of piano playing and singing skill transfer education for years. In this paper, we propose a student centered educational design for skill transfer by adopting the Cognitive Chrono-Ethnography method. We constructed a relation map for piano playing and singing skills and derived 15 critical parameters that should affect the performance of the students. We observed the activities of elite monitors' while they used the educational design we developed. The collected data were analyzed in terms of the critical parameters, and we found that we could classify them into a set of "syntax" parameters and a set of "semantic" parameters. We conclude the skills associated with the former is more easily trained by a student centered educational design than those associated with the latter.

## 1 Introduction

It is a challenging topic to treat "skill transfer education" from the viewpoint of "student centered design." This paper specifically focuses on the skill transfer education in the field of "piano playing and singing", which has been applied to undergraduate students aiming at obtaining teacher's license for kindergarten or elementary school.

Educational design for skill transfer consists of two types of knowledge transfer from trainer to trainee. The first type is teaching explicit knowledge, which includes physically observable measures. For example, Hirai et al. [1] developed a system that focuses on the pitch of trainee's singing. The system tried to cure their poor pitch recognized by the pitch detection technique by presenting differences between the correct pitch and the trainee's *wrong* pitch. The second is teaching implicit knowledge, which includes semantic knowledge such as how to express appropriate emotion in singing. The typical educational design for piano playing and singing so far, however, has only dealt with the first type of knowledge transfer, in which a trainer normally points out problematic places in the trainee's performance by comparing ideal performance with his/her performance in terms of the observable measures. However, this educational design has serious limitations, i.e., the second type of knowledge transfer would never happen since unmeasurable features, e.g., mood of singing, facial expression while singing, and so on, would never be trained.

Traditionally, educational design for piano playing and singing has paid little attention to the second type of skill transfer because it is believed that "explicit" knowledge transfer from trainer to trainee should be trained first, in this field. Indeed, explicit

knowledge consisting of observable measures is one of the important elements in the skill, and therefore the level of skill would be quantified easily by using these measures. However, equally important would be qualitative measures, which would not be able to be measured objectively but only to be evaluated subjectively.

The purpose of this paper is to propose an educational design for piano playing and singing that is capable of transferring skill related to not only explicit knowledge but also implicit knowledge. In order to explore specifications of such an educational design, we adopted a methodology called Cognitive Chrono-Ethnography (CCE), which was successfully applied to understand people's daily behavior [2], for studying how trainees interact with and utilize a proposed educational design in real educational settings, which would eventually lead to an appropriate specification of student-centered educational design for piano playing and singing skill transfer.

Skill transfer in piano playing and singing is important due to the following two reasons. The first is that it involves both explicit knowledge transfer and implicit knowledge transfer, and they interact each other in various ways, making the study a big challenge and a lot of implications to student-centered educational design would derive. The second is related to the special condition in Japan. When someone wants to become a teacher in kindergarten or elementary school in Japan, he/she has to pass the teacher employment exams including an item of piano playing and singing. Due to this, institutions of pre-school/elementary school teacher education have several courses to train the skill necessary for piano playing and singing. However, the courses are usually difficult to run effectively for transferring skills because of the large number of students, typically more than 100, participating in the courses. One of the solutions for the problem of difficulty in effective skill transfer is to develop a student-centered educational design for the complex piano playing and singing skill transfer.

The educational design we have explored so far [4–6] focused on transferring skills required for simultaneous piano playing and singing. Nakahira et al. [6] reported that the design was successful to improve the learners' performance. The design consisted of the following three elements:

- (i) having the trainee watch a video of the model performance for the purpose of building mental image of the performance goal,
- (ii) having the trainee mimic the model performance while referring to guidance comments added on the musical score, and video-record the performance, and
- (iii) having the trainee submit the video and critically review his/her own performance.

This is an important step towards the useful student-centered educational design. However, it was impossible to identify whether (i) or (ii) contributed more effectively in the design. We need to have a deeper understanding of the mechanism of the improvement for developing better student-centered educational design. This can be done by disentangling what happened in (i) and (ii) by applying a methodology for studying people's behavior in the real world settings, such as CCE.

## 2 Methodology

In this research, we adopted CCE, developed by Kitajima et al. [2], to study the trainee's skill acquisition process in the real-world setting. CCE consists of the following six

steps; (1)Choose the field of study, (2)Define critical parameters, (3)Recruit elite monitors, i.e., representative subjects in the space defined by the critical parameters, (4)Observe elite monitors' behavior in the study field, (5)Define a space for representing the observed phenomena, and (6)Analyze the observed behavior from the viewpoint of the critical parameters. In short, a CCE study would provide detailed descriptions for the representative people's behaviors in the study field which is characterized by a set of important, or critical, parameters. The training environment of piano playing and singing in a student centered educational design would be characterized by a set of parameters and trainees' behaviors would be analyzed in terms of the critical parameters to derive which parameters are effective for the training. In the study reported in this paper, we analyzed the trainees' behaviors observed in the educational design elements.

### 2.1 The Field of Student-centered Educational Design

This section describes the field of the study where the student-centered educational design was deployed. We describe the motivation, the selection of elite monitors in the study, and the results of observation in the field.

**Motivation.** The motivation of the study was to clarify the effectiveness of the use of multimedia contents including the model performance and that of annotated musical scores, used in the steps (i) and (ii) of the educational design. This would be done by comparing students' performances in two different conditions. If there is no difference in the improvement of students' performance when we only use annotated musical scores compared with the case in which we introduce both education practices, the annotated musical scores and multimedia contents including the model performance, one can conclude that, in order to transfer skills, it is sufficient to use annotated musical scores. If there are significant differences in the improvement of students' performance between these two cases, it may give us a clear indication that multimedia contents including the model performance are important in transferring skills. As such, we conducted an education practice, focusing only on the use of annotated musical scores. In doing education practice and analyzing students performance, our main viewpoint

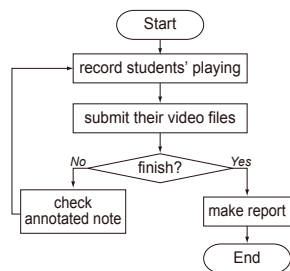


Fig. 1. The educational design.

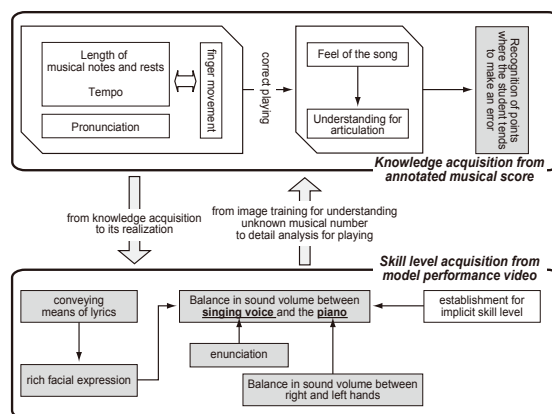


Fig. 2. The relation map for elemental skills of piano playing and singing.

was on how the students' piano playing and singing performance improved. We studied it by using 1) self-analysis reports by students themselves, and 2) comments by the instructors after their video analysis.

**Elite Monitors.** In this practice, the proposed learning approach was applied to 10 third year undergraduate students and one graduate student in K Women's University. The target students attended the class of "Children's Music I" which treats the elementary course of piano playing and singing. When earning their credit, they have improved their skill of piano playing and singing by themselves.

**Observation.** The approach is shown in Figure 1. First, each student selected one or two songs that she wanted to practice for simultaneous piano playing and singing, took a video of her performance using a digital camera, and submitted the video to a designated server via a Web page. Later, she was given an annotated musical score created according to the process described in Fukami et al. [?], and practiced the song, by using the annotated score. After about one week, she took a second video of her performance, and submitted it to the server. At the same time, she was requested to submit a report describing how her performance had changed by using the annotated musical score.

## 2.2 The Relation Map for Elemental Skills of Piano Playing and Singing

Figure 2 shows a map that represents the relationship among the elemental skills of piano playing and singing, from which we can construct a set of critical parameters and the space for representing observed phenomena. In general, the music playing consists of skills necessary for managing "syntactic" and "semantic" knowledge. The syntactic knowledge concerns correct mimic of symbol, such as notes/rests/time, signature/meter, /... . On the other hand, the semantic knowledge includes phrase expression with reference to the musical symbols, such as musical terminology/sign of dynamics/... . In case of singing, the player needs the skills not only to understand and imitate musical symbols but also to understand the meaning of lyric and so on.

To improve the trainee's piano playing and singing skill, he/she has to acquire the following three elemental skills: (1)store the symbols/musical symbols in their memories, (2)synchronize the knowledge of symbols/musical symbols with fingers/body moto, and (3)cultivate their sensitiveness. The first skill is just to store information in their memories, so we do not need to make any innovation here; the third is too difficult to educate; but the second deserves further considerations and we identified 15 elements to be considered for education of skills.

**Synchronized with the Knowledge and Moto (7):** lengths of musical notes and rests, tempo, finger movements, pronunciation, articulation, enunciation, breath,

**Basic Skill for Realizing Sensitiveness (7):** feel of the song, conveying meaning of lyrics, facial expression, balance in sound volume between right and left hands, balance in sound volume between singing voice and the piano, posture during performance, attention to breathing,

**Compound Skill (1):** recognition of points where the student tends to make an error.

Based on these considerations, we came up with the skill map defined by these elements. In CCE, these elements serve as critical parameters, and the skill map is used as the initial expression space to represent the observations to be collected in this study.

**Table 1.** Students' self-evaluation of their performance before and after checking annotated musical scores. The level *A* means "improved their playing". The level *B* means "not improved their playing". The level *C* means "no change". The level *F* means "They did well even before the use of the annotated score". Each level's unit is "%".

Analysis item	level			
	<i>A</i>	<i>B</i>	<i>C</i>	<i>F</i>
(1) Lengths of musical notes and rests	72.7	9.1	0.0	18.2
(2) Finger movement	63.6	18.2	0.0	18.2
(3) Feel of the song	54.5	18.2	18.2	9.1
(4) Recognition of points where the student tends to make an error	45.5	0.0	36.4	18.2
(5) Tempo	45.5	27.3	9.1	18.2
(6) Pronunciation	45.5	18.2	9.1	27.3
(7) Articulation	45.5	18.2	36.4	0.0
(8) Conveying meaning of lyrics	36.4	36.4	9.1	18.2
(9) Facial expressions	36.4	36.4	18.2	9.1
(10) Balance in sound volume between right and left hands	36.4	54.3	0.0	9.1
(11) Enunciation	27.3	45.5	9.1	18.2
(12) Balance in sound volume between singing voice and the piano	27.3	36.4	27.3	9.1
(13) Posture during performance	18.2	9.1	18.2	54.5
(14) Breaths	18.2	27.3	0.0	54.5
(15) Attention to breathing	9.1	18.2	27.3	36.4

### 3 Results and Discussion

Table 1 shows the results. We classified the results into three categories by using the contents described in the students skill improvement reports: (a)almost improved through this training ((1) ~ (7)), (b)not improved through this training ((8) ~ (12)), (c)no need to improve because of their feeling that they have already acquired the skills ((13)~(15)).

In this training, the skill elements which students feel they can make improvement using the annotated scores are almost included in such aspect as "synchronized with the knowledge and moto." On the other hand, students feel they cannot make any improvement using the annotated scores are almost included in such items as basic skill for realizing sensitiveness.

We derived the means for students' skills modification by inferring from these results. For training of synchronization of the knowledge with moto, understanding and memorizing the annotations is one necessary condition for their skill modification to happen. Another skill modification occurred through this training was "feeling of the song and articulation." However, most skill modifications concerning realizing sensitiveness did not occur through this training, including especially "conveying meaning of lyrics", "enunciation", "facial *expressions*." This suggests that the modification check for these elements should require external evaluations.

These results lead the students' centered design for education in piano playing and singing. In case of university students, they have ability of self-instruction for the skills. As shown in this paper, however, some skill elements would be easily self-instructed but the others not. The results of our CCE study clearly showed those skill elements in piano playing and singing that would be easily self-instructed.

## 4 Conclusions

In this paper, we focused the student centered design for education in skill transfer by using the example of piano playing and singing. We followed the CCE methodology to identify critical parameters and understand the trainees' behaviors while they used the student-centered educational design for piano playing and singing skill transfer. We defined 15 critical parameters to observe trainees' skill, and constructed the relation map as the trainees' statements representation. After the observation, we analyzed trainees' playing video and their reports in terms of the critical parameters. The results showed that the parameters were conform to representation of trainees' skill statement, namely which elements they acquired or not. It indicated that the skill elements related syntax was good for self-instruction but the elements related semantic needed external help such as view-to-view instruction. Furthermore, we classified the elements for enabling/disabling self-instruction. We also showed that the annotated musical scores developed by using the ADDIE process was well functioned in the student centered design, which meant that the important points to construct the design.

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