Mediated masterclass teaching

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1. Introduction

In the education of singers of opera and other classical music, an advanced and effective form of instruction is the so-called masterclass. This is a teaching method where an experienced singer observes, instructs, and coaches one single pupil at a time, usually with other pupils as an audience (Smithrim 2003). In masterclass teaching, the interaction between teacher and student is extremely close and intensive. The teacher observes and addresses body stance, tone formation, sound projection, phrasing, breathing, etc. and the interaction is both verbal and physical.

Masterclass teaching is an expensive form of training. In addition, experienced, highly qualified teachers are scarce and students often have to travel extensively in order to attend masterclasses. Could the use of high quality video and audio transmission technique alleviate this problem? Would it be possible to successfully conduct masterclass teaching at a distance while still maintaining the close communication, interaction, and sense of presence required for emotionally intense instruction? What are the critical factors in creating a successful mediated pedagogical situation?

In a proof-of-concept experiment, we have tested the practicality and viability of masterclass teaching at a distance. The teacher was connected to his students using a high capacity video and audio connection. The video equipment used was designed to allow eye-to-eye contact between teacher and student. In addition, the teacher had a secondary screen showing the posture of the student. During two actual masterclass sessions in January 2007, with two different students, the audio and video quality was varied in order to assess how technical quality affects the learning/teaching experience.

Our basic assumptions, based mainly on a model by Enlund (2001), were that mediated masterclass teaching can be a useful complement to live instruction, that the technical quality of the audio and video affects the quality of teaching, and that eye-to-eye contact is important in the creation of emotional contact between teacher and student.

2. Experimental setup

In the experiment, we simulated actual distance teaching by connecting two separate, non-adjacent rooms in the same building by a two-way video and audio connection. It was, indeed, distance teaching even if the geographical distance was only 20 meters.
The two rooms, both rehearsal rooms at the University College of Opera, were similar in size, acoustics, equipment, and layout. The rooms are here denoted as the "teacher room" and the "student room" (figure 1). Each room was equipped with a grand piano and had a set of chairs in the background for the audience. The student was assisted by an accompanying pianist in the student room.

![Figure 1: The layout arrangement and visual interaction equipment of the mediated masterclass teaching experiment.](image)

Both teacher and student stood in front of a specially designed video/audio interaction equipment allowing eye-to-eye contact between the two participants (Gullström-Hughes et al 2003). The equipment consists of a 1.5 meter tall stand with a horizontal flat screen monitor displaying a reverse image that is reflected toward the viewer through a semitransparent mirror. Behind this semitransparent mirror, in the line of sight when viewing the image, is placed a high definition video camera (figure 2). This camera is not visible to the user.

![Figure 2: The principle of eye-to-eye video equipment. Side view on the left, front view on the right in the figure. 1. Video camera directed at the user. 2. Flat video screen in horizontal position. 3. Semitransparent mirror, reflecting the screen image. 4. Projected image. 5. User. (Gullström-Hughes et al. 2003).](image)
The eye-to-eye video devices are crosswise interconnected. When the teacher looks at the image of the student, he/she will see the face of the student in natural size, and when looking directly into the eyes of the student, he/she will look straight into the camera lens. And vice versa for the student. Thus, the effect is one of natural size face-to-face, eye-to-eye communication (figure 3).

In addition, there was a separate video camera in the student room, transmitting a profile, full-body view of the student to a separate standard 24” television monitor in the teacher room. This secondary screen allowed the teacher to observe the posture of the student, albeit not in natural size.

The two eye-to-eye devices were connected through a digital link over coaxial cable, with a digital/analog converter at each end. This was possible due to the short distance between the units – in an actual distance communication situation, the signal would be optically transmitted (Wallin 2007). For recording purposes, the signals were routed to a video server (Tektronix ProFile PDR100) through two dropboxes.

In front of both teacher and student we placed two cardioid condenser microphones (Line Audio Design CM3) for a 120 degree x/y stereo registration. According to the manufacturer, they register sound at 100 – 16000 Hz ± 1.2 dB. On the pianoforte next to the student, we placed two instrument microphones (Neumann KM 184), one “looking up” at the pianist from the left and one “looking down” under the piano cover from the right side. The microphones were connected to the speakers via a mixer unit (Allen and Heath GL2000) with integrated amplifiers. Both teacher and student listened to the sound from the other room through two speakers (Audio Pro A4-14.

Figure 3: Mediated masterclass teaching – a view from the teacher room.
Mk2) placed in front of them to the left and right. This speaker type gives an unusually even frequency response and is generally considered to provide a “natural” sound without coloring. The sound signal was routed from the mixer to the video server for recording. The connection setup is shown in figure 4.

Figure 4: Connection scheme for the mediated masterclass experiment (Wallin 2007).

3. The tests

Two students at the University College of Opera in Stockholm, Sweden, participated in the master class experiment: Paulina Pfeiffer (soprano) and Joa Helgesson (baryton). The teacher was Petteri Salomaa (baryton), professor in vocal music at the Sibelius Academy in Helsinki, Finland. The piano accompaniment was carried out by Thomas Schuback and Mark Tatlow, both professors at the University College of Opera. There was a small audience in each of the two rooms.

Ten different tests were performed, five with each students, each lasting approximately 10 minutes. Each test had a different combination of student, audio quality and image (table 1).
**Table 1: The ten different test cases.**

<table>
<thead>
<tr>
<th>Case</th>
<th>Student</th>
<th>Audio quality</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Joa</td>
<td>Full, with speakers</td>
<td>Eye-to-eye</td>
</tr>
<tr>
<td>B</td>
<td>Joa</td>
<td>Low pass filtering 8000 Hz, mono</td>
<td>Eye-to-eye</td>
</tr>
<tr>
<td>C</td>
<td>Joa</td>
<td>Band pass filtering 300-3000 Hz, mono (telephone)</td>
<td>Eye-to-eye</td>
</tr>
<tr>
<td>D</td>
<td>Joa</td>
<td>Full, with earphones</td>
<td>Eye-to-eye</td>
</tr>
<tr>
<td>E</td>
<td>Joa</td>
<td>Traditional live masterclass, no mediation</td>
<td>Eye-to-eye</td>
</tr>
<tr>
<td>P</td>
<td>Paulina</td>
<td>Full, with speakers</td>
<td>Traditional live masterclass, no mediation</td>
</tr>
<tr>
<td>Q</td>
<td>Paulina</td>
<td>Full, with speakers</td>
<td>Zoomed out</td>
</tr>
<tr>
<td>S</td>
<td>Paulina</td>
<td>Full, with speakers</td>
<td>No image</td>
</tr>
<tr>
<td>T</td>
<td>Paulina</td>
<td>Full, with speakers</td>
<td>Zoomed out</td>
</tr>
</tbody>
</table>

The tests were performed in the order shown in Table 1 with a half-hour break between E and P. We used four variations in audio quality:

- Full quality through speakers. The audio quality corresponds to that of semi-professional stereo equipment, having a 40 – 15000 Hz frequency range.
- Full quality but with both teacher and student using headphones to exclude ambient sound.
- Low pass filtering at 8000 Hz with monaural sound.
- Band pass filtering, 300-3000 Hz, monaural. This corresponds to telephone sound quality.

In the majority of tests we used the eye-to-eye equipment adjusted to show the face of the counterpart in natural size with the eyes located approximately at the camera position. In two cases, the images of both student and teacher were zoomed out to show full figures. The teacher had an auxiliary screen showing the posture of the student in profile. In one test case, S, no images were shown and the communication took place through audio only. Cases E and P were reference cases with teacher and student interacting in the same room.

**4. Results**

**4.1 Assessment procedure**

The teacher, the students and the audience were all asked to evaluate the pedagogical aspects of each test variation and to comment on how they experienced the teaching situation. Evaluation forms were distributed and they were filled in by everyone immediately after each of the the test sessions. On the form, each person was asked to indicate his/her role (teacher, student, accompanist, audience) as well as his/her location (student room, teacher room). There were then five questions asked concerning perceived sound quality, physical observation, emotional contact, pedagogical quality, and the practical viability of the teaching situation. The questions were answered on a six-level Likert scale. After all tests were completed, the participants and the audience were asked to give general comments on this type of mediated masterclass teaching.

The results reported here can only be considered as indicative. The assessment questions were formulated in an intuitive manner and the number of respondents was very limited – in most test cases 8-9, but in a few cases only 3 and 4.
4.2 Sound quality

The question "how natural does the audio from the other room sound?" was answered on a scale from "unnatural" to "very natural" as in figure 5. This and the following diagrams show only the mean values since the number of answers was too small to allow any statistical analysis.

The sound quality was generally deemed to be rather good (>4). Only test case C – telephone quality – received a distinctly lower rating. Surprisingly enough, test case B – low pass monaural – was judged to have as good a quality as the tests with full quality stereophonic sound. Cases E and P – live teaching – did not receive full marks since part of the audience was in the other room.

![Figure 5](image1)

**Figure 5:** "How natural does the audio from the other room sound?" 1 = unnatural, 6 = very natural.

![Figure 6](image2)

**Figure 6:** "How well are you able to assess the physical performance of the student?" 1 = poorly, 6 = well.

"The sound seems to come out of a tin can, but since I already have experienced working with better sound quality, this is still acceptable." (Teacher, test C)

"The headphones give a much better sound experience but they limit physical mobility." (Teacher, test D)

4.3 Physical observation

A question regarding the ability of a teacher or observer to assess the physical performance (stance, facial expressions, support, breathing, tensions, etc) of the student was answered as in figure 6. There seems to be no simple explanation for the variations in rating between the cases, except that the session without video connection (S) was clearly unacceptable.

"It is important to have an image background that makes the face and body of the student stand out clearly." (Audience, test B)

"The profile, full-body view screen is very valuable as a complement to the eye-to-eye screen in judging physical activity and stance." (Teacher, test A)

"Zooming out the image on the eye-to-eye screen has both advantages and disadvantages. It becomes easier to assess body language but more difficult to see facial expressions." (Audience, test R)
4.4 Emotional contact

All participants were asked to judge to what extent they did experience emotional contact and intimacy between teacher and student. The results indicate that the quality of contact is not affected by the audio quality (figure 7). The image quality, however, is important: a zoomed-out view or the absence of video is clearly detrimental.

"The quality of the contact was partly a result of the unusual communicative ability of the teacher." (Student, test B)
"In a certain sense the contact becomes more intense in a mediated situation since matters that could be expressed physically in a non-mediated situation will have to be formulated in words." (Audience, test Q)

![Figure 7: “To what extent do you experience emotional contact and intimacy between teacher and student?” 1 = distant, 6 = good contact.](image1)

![Figure 8: “How well does the pedagogical situation function?” 1 = poorly, 6 = well.](image2)

4.5 Pedagogical quality

The participants were asked to evaluate the pedagogical aspects of the mediated masterclass teaching situation. The ratings were generally very favourable, except in the no-video situation (figure 8). Reduced sound quality (C) and a zoomed-out image (R) had a somewhat detrimental effect.

"After a while, you completely forget that the student is inside a box." (Audience, test A)
"The communication between teacher and student is much better than could be expected. As a complement to actual meetings, this is very valuable.” (Student)

4.6 Viability

Finally, the participants were asked whether they would be willing to participate in this type of mediated masterclass teaching in an actual educational process. The answers were overwhelmingly positive (figure 9). Only the no-image situation was felt to be unacceptable.
"The technology is quite acceptable and useful as a complement to—but not a replacement for—live interaction." (Teacher)
"Please, continue to develop this teaching method! I will gladly participate in future experiments.” (Student)

Figure 9: "Would you be willing to participate in this type of mediated masterclass teaching?" 1 = not on my life, 6 = eagerly.

4.7 General comments

A number of general comments on the experiments were provided by the participants. Here are just a few selected opinions:

"The technology is clearly usable and can be used to complement live teaching, although not to completely replace it." (Teacher)
"It would be advantageous, if the teacher could control the zoom of the camera capturing the student’s face. Sometimes he needs to move in closer, sometimes get a full view." (Audience)
"Working in the same room as the teacher is an unsurpassable situation. It creates synergies, impulses and sometimes magical moments that cannot possibly arise without direct personal contact. Still, mediated teaching worked much better than I had expected. [...] It should not, however, completely replace physical meetings with the teacher.” (Student)
"There were moments when I actually felt like being in the same room as the teacher. He ‘stepped out of the box’. “ (Student)

5. Conclusions

The results clearly indicate that mediated masterclass teaching using eye-to-eye video communication is a workable proposition and that technical audio quality plays only a limited role due to the emotional intensity of the learning situation. The perceived quality of the educational situation is more dependent on technical video quality than on audio quality. A high-definition close-up image with eye-to-eye contact, supported by a full-figure profile image, and in combination with a stereo sound of consumer electronics quality is sufficient for meaningful masterclass education. The technology provides satisfactory information for the teacher to be able to judge also physical performance and anatomical aspects. It can also create a sense of emotional contact and intimacy between teacher and student.
Possibly, the overwhelmingly positive attitude among all participants toward the experiment and concerning the viability of mediated masterclass teaching may be partly due to personality factors. The teacher appeared to have an exceptional ability to create close personal contact even at a distance – an ability to “pass through the screen”. All teachers may not be equally skilled in this aspect.

![Image of a person pointing at a screen](image)

*Figure 10: Mediated masterclass teaching session – view from the teacher room showing secondary display screen.*

Naturally, the experiment reported here can give only indicative results. A more thorough study would require a large number of tests with several teachers and a larger selection of students. The pedagogical situation should be evaluated by a representative body of professional singers and voice teachers. A number of technical and situational parameters should be varied and the outcomes evaluated to determine the effect of technical restrictions on the educational practicability of this form of distance education. All this still remains to be studied.

Nevertheless, we believe that this simple experiment shows that video and audio mediated masterclass teaching can become a low-cost complement to musical education.

6. Acknowledgements

The work described here was carried out as part of the activities of the Research Centre for Opera and Technology, a research cooperation between the University College of Opera and the Royal Institute of Technology (KTH), both in Stockholm, Sweden. Financial support from Kulturfonden för Sverige och Finland made cooperation with the Sibelius Academy in Helsinki, Finland, possible.
8. References


