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**Communicating musical knowledge through gesture: piano teachers' gestural
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Version 3

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Communicating musical knowledge through gesture: piano teachers' gestural behaviours across different levels of student proficiency

Abstract

Teachers' communication of musical knowledge through physical gesture represents a valuable pedagogical field in need of investigation. This exploratory case study compares the gestural behaviour of three piano teachers while giving individual lessons to students who differed according to piano proficiency levels. The data was collected by video recordings of one-to-one piano lessons and gestures were categorised using two gesture classifications: the spontaneous co-verbal gesture classification (McNeill, 1992; 2005) and spontaneous co-musical gesture classification (Simones, Schroeder & Rodger, 2013). Poisson regression analysis and qualitative observation suggest a relationship between teachers' didactic intentions and the types of gesture they produced while teaching, as shown by differences in gestural category frequency between teaching students of higher and lower levels of proficiency. Such reported agreement between teachers' gestural approach in relation to student proficiency levels indicates a teachers' gestural scaffolding approach whereby teachers adapted gestural communicative channels to suit students' specific conceptual skill levels.

Keywords

Instrumental music teaching, musical learning, gesture, bodily movement, non-verbal communication, education.

In instrumental music teaching and learning, gestures assume multiple roles: they are an essential and integral aspect for the communication between teachers and students in the same way that they are essential for playing, teaching and learning to play the intended musical instrument. More specifically, gestures are involved in the acquisition of practical knowledge in relation to the motor aspects of playing a musical instrument, conceptual musical knowledge needed to perform and interpret the musical material, and communicational aspects required for learning how to communicate music. If such is the importance of gesture for music making, and music making is in itself rooted in educational

practices, why has only scant consideration been given to the gestural aspects of instrumental musical pedagogy? Several inter-related factors have contributed to this state of affairs.

Firstly, research into instrumental music teaching has mostly focused on verbal communicational aspects around a nexus of issues including: teachers' conceptualisations of teaching (e.g. Hallam, 2006); how individual differences influence teaching practices (Jorgensen, 2002; Kostka, 2002; Madsen, 2004); the role of context in shaping methods and curriculum practices (Green, 2001; Lamont, 2002; Burwell, 2006; Gaunt, 2008); corrective feedback (Sink, 2002; Bergee, 2003; Parkes, 2011); dual roles of teachers as teachers and performers (Jorgensen, 2000; Parncutt, 2007; Parkes, 2009); interactions between teachers and students in the classroom (Creech and Hallam, 2003; 2011; Byrne, 2005); and teaching effectiveness (for reviews see Kennell, 2002 and Parkes, 2009).

Secondly, research focused on the study of body movement and gesture in music performance in the context of the western classical music tradition (e.g. Davidson 1994; 2001; 2005; Wanderley & Vines, 2006; Dahl & Friberg, 2007; Poggi, 2011) mostly considered performance as a final construct, and has overlooked aspects such as how teaching and learning influence movement/gestural features during musical performance.

Thirdly, in the earlier attempts to study gesture in instrumental teaching, gesture has been considered under the term non-verbal behaviour (e.g. Gipson, 1978; Hepler, 1986; Levasseur, 1994; Carlin 1997, Kurkul, 2007). This term has contributed to a reductionist view of the role and importance of gesture by implicitly assuming a submissive role to gestures in relation to verbal content. In addition, the term is misleading as some of the categories set by previous researchers, such as 'facial expression and eyes', (e.g. Levasseur, 1994) and 'physical initiating' (e.g. Gipson, 1978), often occur alongside verbal behaviours.

Despite these problems, findings from the literature suggest that so-called non-verbal behaviours play an important role that needs to be acknowledged and further studied. In the

classroom for instance, successful voice teachers frequently use the following non-verbal actions during lessons: steady eye contact, forward posture, head nodding, smile and laughter, appropriate touch, animated facial expressions, and the use of expressive gestures (Levasseur, 1994). In other research findings, such was the frequency and importance of these types of gestures that verbal and non-verbal teaching behaviours were considered as equally important (Wang, 2001). Piano teachers who performed more non-verbal behaviours were deemed by students as most effective (Carlin, 1997) and non-verbal sensitivity plays a significant role in the teaching of music performance (Kurkul, 2007). In line with the findings of the above research, non-verbal behaviours are important for human-to-human communication in the context of instrumental teaching and can have an impact in terms of teaching effectiveness. Therefore, a number of questions need to be investigated: what is the role of gesture in the teaching context, in terms of communicating musical knowledge, and in the creation of musical meaning and communicating more generally? If aspects of gesture correlate with teaching efficiency, are teachers' gestural behaviours adapted to students' skill levels? If so, what are the direct implications and outcomes of teachers' gestural behaviours for student learning? And more importantly, what can teachers learn from such an understanding that can improve teaching practice in terms of optimising students' learning process and experience?

In fact, as revealed by research in the field of psycholinguistics, gestures not only convey meaning in themselves, but constitute part of a unified system with speech in which speaking and gesturing are inextricably bound (Goldin-Meadow, 2003; McNeill, 1992). As an essential aspect of musical production (Davidson 2005, 2006, 2007) the previously mentioned unified system (gesture and speech) can be extrapolated to the musical arena to include a unified system that includes gesture, music and music making (Davidson, 2005; Wanderley & Vines, 2006; Simones et al. 2013). In relation to human-to-human communication, teachers' spontaneous co-verbal gestures (synchronous with speech)

(McNeill, 1992; 2005) have been shown to have a variety of roles in relation to students learning effectiveness: studies have shown that in learning mathematics, learners learn more effectively when teachers gesture and also when learners are taught to use gestures that meaningfully match the learning content or provide insights into problem-solving strategies (Goldin-Meadow, 2003); gestures reflect conceptual understanding and have a role in how learning is maintained over time (Cook, Mitchel and Goldin-Meadow, 2008); and gestures correlate with intersubjectivity levels between people in terms of the sharing of thoughts, feelings, and linguistic meanings (Muller, 2008; Zlatev, Racine, Sinha & Itkonen, 2008). As such, gesturing people appear to be sensitive to individual aspects of their addressees. In instrumental music, recent research found a relationship between the didactic intention of piano teachers and the forms of gestures they use to communicate information to the students in piano grade 1 (Simones et al., 2013). Would a similar relationship be present for piano teachers teaching students in other piano proficiency levels and how consistent would this be across teachers? Understanding teachers' gestural specificities in relation to student skill level can provide information regarding the process of musical communication in the instrumental classroom and may be a basis for studying the efficiency of such gestures for student learning.

As such, the research questions posed for this investigation are:

- 1) What gestures are performed by piano teachers while teaching piano to different levels of student proficiency?
- 2) What differences and similarities can be found in teachers' combined and individual gestural approaches while teaching piano to different levels of student proficiency?

Terminology is important given different gesture definitions, so for this article gesture is defined as a body movement in the pedagogical process of music making that carries either an intention (Gritten & King, 2011) or a perceived meaning (Hatten, 2006). Focus is

specifically on teachers' gesticulations, classified from two perspectives: 1) spontaneous movements of the hands and arms that accompany speech that are not associated with a practical music making experience (spontaneous co-verbal gestures, McNeill 1992; 2005); and 2) spontaneous movements of the hands and arms specifically dedicated to music making, that communicate symbolic and/or functional musical knowledge (spontaneous co-musical gestures, Simones et al., 2013). To clarify, spontaneous co-verbal gestures are considered for instances where people may be 'talking about music' or 'talking about something else' and spontaneous co-musical gestures in situations where people are actively engaged in a practical experience of music making, that can in itself include verbal spoken language.

Method

Participants

Three female piano teachers took part in the study and were from different European countries. Their ages ranged between 39 to 55 years and their teaching experience between 20 to 30 years. All had a music PhD and specific accreditation for piano teaching.

Initially, the twelve students participating in the study were divided in four groups (each of three students) according to their proficiency levels: pre-grade 1, grade 1, grade 4, and grade 8. However, a preliminary analysis revealed similar gesture types results between teachers teaching students in pre-grade 1 and grade 1 and between grades 4 and 8, so four groups were amalgamated to two as follows:

- Group I: students in piano pre-grade 1 and grade 1 with ages ranging between 5 and 10 years old (4 females and 2 males).
- Group II: students in piano grades 4 to 8 with ages ranging between 11 and 35 years old (5 females and 1 male).

Student skill proficiency was equivalent to the requirements of the Associated Board of the Royal Schools of Music.

Materials

The observation material consisted of a total of 72 video recorded teaching sessions. The recordings were obtained using a Sony video high definition camera, placed laterally to the piano in order to capture the student and respective piano teacher. The digital video was transcribed and annotated using the ELAN Software package (Lausberg & Sloetjes, 2009).

In each session, teachers worked with students on two pieces of a set repertoire, chosen according to students' skill level, as follows: Pre-grade 1: Birds (unknown composer) and Crane by M. Krashev, both compiled and edited by A. Nikolaev, 1978; Grade 1: Lullaby by I. Philippe and Study by G. Humbert, both compiled and edited by A. Nikolaev, 1978; Grade 4: Invention n.4 in D minor, J. S. Bach, BWV 775 and Adagio in A minor by D. Steibelt; Grade 8: Invention n. 13 in A minor, J. S. Bach, BWV 784 and Nocturne in B major, op. 32, n. 1, by F. Chopin.

Procedure

A total of six teaching sessions for each of the teacher and student dyads were obtained, from which the first three minutes were analysed, to standardise the time window of the teaching process that was examined in each lesson. The recordings were aimed at capturing first stages of engagement with the set repertoire in typical day-to-day pedagogical interaction and as such, participants were unaware of the focus on gesture.

Analysis

Categorisation. Through qualitative observation, gestures were identified, observed for consistent differences across teachers and classified using the following mutually exclusive gestures classifications: 1) spontaneous co-verbal gestures (McNeill, 1992; 2005) and 2) spontaneous co-musical gestures (Simones et al., 2013). McNeill's (1992; 2005) classification of spontaneous co-verbal gestures contains four categories: Deictic (pointing gestures); Iconic (express images of objects or actions); Metaphoric (express images of the abstract); and Co-verbal Beats (up and down movements of hand, arms or head that serve to highlight information occurring at the meta-level of discourse). The recently devised classification of spontaneous co-musical gestures contains five categories: Musical Beats (up and down movements of hands, arms and or head denoting the speed or tempo intended for performance without providing expressive musical information); Conducting Style gesture (up and down movements of hands and arms that assume in general a rounder shape and provide both temporal and expressive information about the music); Playing Piano gesture (refers to instances where teachers are actively engaged with music making for the purposes of demonstrating and modelling); Mimic (refers to gestures used by the teacher in the course of a gestural demonstration intended at showing students how to perform a particular musical sound producing action while expecting the student to imitate the gesture shown); and Touch (instances where teachers established physical contact with the student while teaching, such as touching students' hands, wrists, arms).

Inter annotator reliability was assessed (in accordance with Bakeman and Gottman's 1986 requisites for observational techniques) for 20% of the totality of the gestures identified. The annotators were experienced piano teachers, with previous experience of gestural annotation and to whom the processes of gestural identification were carefully explained/revised. Cohen's (1960) Kappa agreement levels ranged from .86 to .89 (all $p < .05$), based on 484 reference gestures.

Statistical analysis. The primary aim of the statistical analysis was to compare teachers' gestural performance while teaching each of the two student groups in question. Given the fact that the data consisted of a number of frequencies of categorical data, positively skewed, Poisson regression was considered the most suitable approach for establishing such comparison. This method gives the difference between frequencies of each gesture type performed by teachers for each student group, in the form of a ratio (if there is no difference at all between the two student groups the ratio is equal to 1). Aiming for a realistic picture of the context, two Poisson regression analyses were conducted respectively on 1) totals of combined teachers' gesture type occurrences per student group and 2) total individual teacher gesture type occurrences per student group. The confidence interval for this study was set at 95%.

Results

A total of 2418 gestures were identified and categorised. For each teacher in this study the most frequent gestures performed while teaching both student groups were Deictic (pointing) gestures and Playing Piano. Subsequent analysis compared gesture frequencies of all teachers combined, and separately, gesture frequencies of individual teachers.

Gestures performed by the three teachers combined

The comparison of the combined occurrences of teachers' gesture types while teaching the two student groups in the study can be seen in Table 1 (below), in which the last two columns show the results of the Poisson regression analyses. The difference between the occurrences of teachers' gesture types for students in Group II (grades 4-8) is given in relation to students in Group I (pre-grade 1 and grade 1). Metaphoric, Iconic, Co-verbal Beats and Conducting

Style gestures were all significantly more common for students in Group II rather than Group I: the occurrence of Metaphoric gestures was 4.7 times higher, whilst the occurrence of Conducting Style gestures was 13.0 times greater for Group II. Conversely, Deictic, Mimic and Touch gestures were all significantly less common while teaching students in Group II in relation to Group I: Mimic gestures were only a third as common (or three times fewer) for teaching students in Group II than for students in Group I. A statistically significant difference between the two groups of students was not found, however, for Musical Beats and Playing Piano gestures (see table 1).

[Table 1 – here]

Gestures individually performed per teacher

The results of Poisson regression carried out on individual gestural occurrences per teacher (Table 2, below) suggest that for some gestures the results were consistent between the three teachers, but for other gestures there were some differences in terms of the results obtained. Teachers' individual results were consistent and statistically significant for Metaphoric gestures and Co-verbal Beats, both more common for all teachers for students in Group II than for Group I. Iconic gestures were also more likely for students in Group II for Teachers 1 and 2, but there was no statistically significant difference for Teacher 3. There was no difference between student groups for Musical Beats for Teachers 1 and 2, but for Teacher 3 this gesture type was more common for students in Group II than for students in Group I. The occurrence of Conducting Style gestures was not significantly different between student levels for Teacher 2. However, a formal comparison was not possible between groups for Conducting Style data belonging to Teachers 1 and 3 due to the zero occurrences for students in Group I, although there were occurrences for students in Group II for both teachers. The

results for the Playing Piano gesture varied between the three teachers: there was no difference for Teacher 2, but it was significantly lower for students in Group II for Teacher 3 and significantly higher for students in Group II for Teacher 1. The Mimic results suggested no differences between groups for Teachers 1 and 2, whilst the Teacher 3 results suggested fewer occurrences for students in Group II when compared to students in Group I. Touch gestures were significantly fewer for students in Group II based on the data from Teachers 1 and 2. There were no occurrences at all for Teacher 3 for either student group.

[Table 2 – Here]

Qualitative observation revealed specific consistent differences across teachers in relation to student experience level in the use of Deictic and Touch gestures. In using Deictic (pointing) gestures, teachers tended to point more at the students' hands and the piano keys while teaching students in pre-grade 1 and pointed more to the musical score when teaching students from grade 1 onwards. In addition, two of the teachers were observed touching students' hands and, while doing so, playing piano with students' hands when teaching students in Group I, an action not observed while teaching students in Group II.

In sum, despite a certain level of disagreement between teachers in terms of the use of Musical Beats and Playing Piano gestures in individual results across student piano proficiency levels, the findings suggest a considerable level of agreement for the three teachers in higher usage of certain gesture types for specific student groups. Teachers' individual performances were in agreement with the combined results, except for the following: Teacher 3 did not perform Touch gestures for either student group; contrary to other teachers, Teacher 3 displayed higher frequencies of Iconic gestures for students in Group I; and Teacher 2 displayed higher frequencies of Mimic gestures for students in Group

II. Additionally, despite a certain level of agreement between the three teachers in terms of higher gestural frequencies for certain student groups, statistical significance in the individual results for each of the three teachers was only achieved for Metaphoric and Co-verbal Beats gestures. This can be attributed to lower frequencies of gesture types when looking at an individual teacher's results, in relation to teachers' combined results.

Discussion

The agreement reported in the present study between teachers in relation to students' experience levels is suggestive of a teacher's gestural scaffolding approach, in which they adapted gestural communicative channels to suit students' specific conceptual skill levels. In this regard, there are specific insights that this study can provide in terms of gestural scaffolding processes in piano teaching. Deictic gestures (pointing: performed more frequently by all teachers for students in Group I: pre-grade 1 and grade 1) appeared to have an important role in ascribing meaning to the icons/symbols in the score and in relating them to the experience of music making, both as a motive for and result of action. Thus, the pointed symbolic icons were translated to a practical self-experience which engaged mind and body, a process aided by teachers who frequently employed verbal explanations of contents alongside Deictic gestures during the students' performance experience processes. The fact that teachers pointed considerably more often at the students' hands and piano keys while teaching students in pre-grade 1, and pointed more to the musical score when teaching students in grades 1, 4 and 8, seems to emphasise a shift in the teaching process. In the earlier stages, a teaching practice based on a purely action-making activity seems to gradually give way to the importance given to the symbolic ascription of meaning to the musical icons as written in the score.

The higher usage of Metaphoric gestures (express images of the abstract, 4.7 times higher for students in Group II) and Iconic gestures (used for describing action, 2.0 times higher also for students in Group II), points to teachers' increased focus on musical-conceptual and motor-functional knowledge with advancing student proficiency level. As stages of learning advanced, teachers departed from the bare minimum of the perceptual-motor components of the task and appeared to gear the learning process towards the understanding of the activity in a more meaningful way. This way, they appeared sensitive to the importance of learning through hands-on experience as suggested by Piaget (1936) and Vygotsky (1986), building on the knowledge gained through action and introducing new knowledge gradually.

The results of Conducting Style gestures (13.0 times greater for students in group II and highly associated with singing, used for teaching aspects such as expression, phrasing and consistency of tempo) supports the above conjecture that teachers' gestural intentions are adapted towards higher-order musical elements in teaching more proficient students. Studied from a point of view of orchestra/choir direction (Boyes Braem & Braem 2004; Poggi 2007, 2011) and co-performers communication (Davidson & Good, 2002; Williamon & Davidson, 2002; Rahaim 2008; Goebel & Palmer, 2009), only minimal reference is made to Conducting Style gestures in the music instrumental pedagogical literature (i.e. Neuhaus, 1973; Simones et al, 2013). Since communication of emotion seems to be an agreed criterion when accounting for performance quality (Prince, 1994; Hallam, 2010; McPhee, 2011) and conductors gestures are by definition communicative (Poggi, 2011), it would be expected that teachers would use Conducting Style gestures to promote students' development of expressive skills from the earliest stages of learning. However, apparently, teachers in this study considered that students at the early stages of learning were not ready for working on expressivity, in line with findings that instrumental music teachers appear to focus more on

technique rather than expressivity (Karlsson & Juslin, 2008). The above contradiction between established teaching practice and recent views on music education as a platform for developing ‘expressive, communicational and affective musical interactions’ (Welch & McPherson, 2012) from the earliest learning stages highlights the need to explore strategies for teaching musical expression and communication. Mimic gestures were three times more common while teaching students in pre-grade 1 and grade 1 and the significant difference between student groups points to an important role that imitation appears to have for teaching body usage in playing a musical instrument at the early stages of learning. On one hand, instrumental teaching is criticised on the basis that teaching methods are often based on imitation and as such, do not lead to developing interpretative meaning-construction (e.g. Rodrigues, Rodrigues & Correia, 2009). Such preconceived notions of what creativity is, or is meant to be, appear to conflict with the role of imitation in the process of children’s musical socialisation and in promoting and enabling creativity. On the other hand, claims that imitation *is* an important pillar for children’s socialisation (e.g., Bandura, 1977) are in accordance with evidence from the field of mirror-neuronresearch, which suggests that accommodating and appropriating the actions of others in one’s bodily experience can provide an understanding of their motivations and intentions (Tolbert, 2001; Rizzolatti & Arbib, 1998; Overy & Molnar-Szakacs, 2009). Studying the mediator signs in this human interaction and how they are used by teachers teaching children of different conceptual levels, appears to be a step forward in terms of understanding how musical communication is developed.

This work also provides a realistic demonstration that music production is intrinsically dependent upon gesture and body movements, as is the teaching process itself. Attempts made in terms of identifying and describing processes of imitation (e.g. Byrne, 2005; Young, 2005) would benefit from a specific consideration of gestural approach in

terms of teaching guidance. Mimic gestures, as observed in this study, provided the form and trajectory of the intended action, while Touch (significantly more common for students in pre-grade 1 and grade 1) can not only guide and support the child in the action, but also serves as a channel for emotional communication: love, gratitude, and sympathy can be communicated between teachers and students through touch, and children who learn to communicate such emotions have been shown to be more cooperative in their interactions with others (Herterstein, Keltner, App, Bulleit & Jaskolka, 2006). As such, Touch appears to provide a platform for teaching the essential haptic contact required to play a musical instrument, in addition to being a form in itself of establishing communication with others and developing musical communication.

The present findings are suggestive of the importance of studying gestural scaffolding processes in the music instrumental teaching and learning context as the encoding of musical communication encompasses both verbal and gestural signs, through which interpretative meaning construction is developed. Previous research into scaffolding processes in the instrumental music context ascribed an important role to both verbal and non-verbal modelling (e.g. Dickey, 1992; Goolsby, 1996; Wang 2001; Sink, 2002). However, little attention has so far been given specifically to the so-called non-verbal modelling aspects of teaching to play a musical instrument. Recent calls for the importance of musical facilitators developing their practice by making a more extensive and optimised use of non-verbal modelling (Creech, et al., 2013) need to be accompanied and complemented by a deeper understanding of these so called non-verbal behaviours. In this regard, the term gesture instead of non-verbal behaviour appears to provide helpful insight for such study by allowing equal importance to verbal and gestural channels and acknowledging that verbal and gestural features can, in fact, occur simultaneously and complement each other.

Recommendations for teaching stemming from these findings should only be brought forward with an understanding of the importance of teachers' gestures for student learning. As such, the priority from a research point of view is to understand if teachers' gestures are helpful for student learning and, if so, how and to what extent. If it is convincingly demonstrated that teachers' gestures are important for student learning, the next step could be the establishment of a gesture pedagogy for this context, based on empirical findings, that can be taught to prospective instrumental teachers at a university level and hopefully contribute to enhance teaching efficiency. This should constitute a major focus of future investigations that could also approach such study by viewing the data from students' perspectives, using and extending the framework presented here to instrumental tuition in other musical instruments (including vocal teaching), and expanded to small and large group ensembles.

This investigation is limited due to the small sample of teachers and students. In addition, only the first three minutes of each teaching session were analysed. It should also be stressed that the teacher population in this study was comprised of experienced individuals and as such more research is required to understand what teaching differences there may be between novices and experienced teachers. Furthermore, students' proficiency levels ranged from pre-grade 1 to grade 8 and it is possible that teaching more advanced piano players would generate alternative results. These findings are particular to the western classical music tradition and considerations about other musical cultures need to account for contextual specificities.

Conclusion

The results suggest a relationship between the didactic intention of the teacher and the forms of gesture they employ to communicate information to the student. Such a relationship manifests through: a statistically significant difference in teachers' combined gestural

performance across students proficiency levels (with the exception of Musical Beats and Playing Piano gestures); a tendency of higher gestural production of certain gesture types for certain student proficiency levels, consistent with most of the teachers' individual results (exception for Playing Piano and Musical Beats gestures); and qualitative differences in the use of Deictic and Touch gestures according to student proficiency levels.

The agreement reported between teachers in relation to student experience levels suggest a gestural scaffolding approach in the piano teaching context in which teachers are sensitive to piano-learners' conceptual levels and vary their gestural approaches in accordance to student skill levels. It is through this scaffolding process that the encoding of musical communication (through verbal and gestural signs) and interpretative meaning construction is developed. Further research is needed for understanding this eclectic and ecological lexicon in development which can help explain the meaningful relationship between teaching/learning experiences in a music instrumental environment.

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Ethical Approval

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TABLES

Table 1. Poisson regression results on teachers combined gesture occurrences

Gesture types	Occurrences for students in Group I	Occurrences for students in Group II	Ratio (Int/Beg) (95% CI)	P-value
Deictic	374	305	0.82 (0.70, 0.95)	0.008
Metaphoric	46	215	4.67 (3.40, 6.43)	<0.001
Iconic	95	193	2.03 (1.59, 2.60)	<0.001
Co-verbal Beats	92	191	2.08 (1.62, 2.66)	<0.001
Musical Beats	52	51	0.98 (0.667, 1.44)	0.92
Conducting Style	2	26	13.0 (3.09, 54.8)	<0.001
Playing Piano	230	206	0.90 (0.74, 1.08)	0.25
Mimic	155	52	0.33 (0.25, 0.46)	<0.001
Touch	124	9	0.07 (0.04, 0.14)	<0.001

Table 2. Results of Poisson regression analysis on gestures occurrences individually performed per teacher.

Teacher	Gesture Types	Occurrences Students in Group I	Occurrences Students in Group II	Ratio (Int/Beg) (95% CI)	P-value
Teacher 1	Deictic	169	125	0.74 (0.59, 0.93)	0.01
	Metaphoric	14	90	6.43 (3.66, 11.3)	<0.001
	Iconic	22	100	4.55 (2.87, 7.21)	<0.001
	Co-verbal Beats	25	51	2.04 (1.26, 3.29)	0.003
	Musical Beats	42	28	0.67 (0.41, 1.08)	0.10
	Conducting Style	0	18	(*)	(*)
	Playing Piano	43	63	1.47 (0.99, 2.16)	0.05
	Mimic	19	16	0.84 (0.43, 1.64)	0.61
	Touch	15	2	0.13 (0.03, 0.58)	0.007
Teacher 2	Deictic	98	90	0.92 (0.69, 1.23)	0.56
	Metaphoric	29	80	2.76 (1.80, 4.22)	<0.001
	Iconic	42	64	1.53 (1.03, 2.25)	0.03
	Co-verbal Beats	52	100	1.92 (1.38, 2.69)	<0.001
	Musical Beats	5	1	0.20 (0.02, 1.71)	0.14
	Conducting Style	2	4	2.00 (0.37, 10.92)	0.42
	Playing Piano	71	56	0.79 (0.56, 1.12)	0.18
	Mimic	12	19	1.58 (0.77, 3.26)	0.21
	Touch	109	7	0.06 (0.03, 0.14)	<0.001
Teacher 3	Deictic	107	90	0.84 (0.64, 1.11)	0.23
	Metaphoric	3	45	15.0 (4.67, 48.3)	<0.001
	Iconic	31	29	0.94 (0.56, 1.55)	0.80
	Co-verbal Beats	15	40	2.67 (1.47, 4.83)	0.001
	Musical Beats	5	22	4.40 (1.67, 11.62)	0.003
	Conducting Style	0	4	(*)	(*)
	Playing Piano	116	87	0.75 (0.57, 0.99)	0.04
	Mimic	124	17	0.14 (0.08, 0.23)	<0.001
	Touch	0	0	(*)	(*)

(*) No formal analysis possible due to no gestures in one or more student group