Establishing Reliability and Validity of a Tool for Large Ensemble Teacher Use of Space and Interactions

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Abstract

The primary purpose of this study was to design a reliable and valid continuous-time coding tool for measuring teacher use of space and teacher interactions based on prior research (Hesler, 1972; Martin, 2002). The tool captured teachers' use of space as they moved through 14 identified areas of the large instrumental ensemble classroom and engaged in 10 types of verbal and musical interactions with students. Evidence for content validity is presented, and the tool was found to have high inter-rater reliability. The secondary purpose of the study was to explore the effect of a brief expository lesson on preservice instrumental music teachers' use of classroom space and proximity while teaching, with specific emphasis on teachers moving away from the podium and toward and among students. The expository intervention changed teachers' use of space during the lesson immediately following the intervention (i.e., teachers spent less time on the podium and more time moving toward and among students), but the behaviors did not persist over time.

Introduction

Nonverbal behaviors have been studied extensively in conducting or ensemble rehearsals (e.g., Byo & Austin, 1994, Price & Winter, 1991; VanWeelden, 2002; Yarbrough, 1975; Yarbrough & Price, 1981) and in one-on-one lessons (e.g., Kurkul, 2007; Levasseur, 1994; Wang, 2001; Zhukov, 2012). These behaviors typically include eye contact, vocal expression, gestures, facial expressions, touch, and proximity. However, proximity and teacher use of classroom space are particularly underexplored. Additionally, proximity behaviors in the extant literature are often limited to a relatively narrow scope of behaviors. For example, as far as can be determined, there is no research in music education with the primary aim of exploring teacher use of space while teaching. Moreover, proximity-related behaviors in existing research tend to limit notions of proximity to relatively subtle behaviors like "lean forward" (toward an ensemble or student) rather than a wider possibility of moving around a classroom. As many teachers

intuitively understand, physical use of space and proximity play a role in our communication with students and influence student behaviors. Accordingly, issues surrounding teacher use of space and proximity warrant further exploration.

Exacerbating the limited literature pertaining to teachers' use of space, some researchers have found that music teachers may be relatively unaware or unconcerned with issues of physical space. Brewer and Rickels (2014) completed a content analysis of 14,854 entries to the Band Directors Group page on Facebook. The researchers analyzed both posts and comments by members of the group and found that 0.8% of the entries ($N = 239$) were related to "organizing physical space." In Teachout's (1997) study, also replicated by Davis (2007), "move toward and among students" was ranked 34th by preservice teachers, 33rd by experienced teachers (Teachout, 1997), 30th by students taking their first music education course, and 34th by student teachers (Davis, 2007)[1] from a list of 40 important teaching skills.

Galloway (1970) argues that the organization of our classrooms and the use of space by teachers may have important implications for teaching and learning. He describes classrooms as containing separate "territories" for the teacher and for the students, and that these territories often remain "static" (p. 9) throughout the school year. Additionally, Galloway suggests the occupation of classroom space by teachers conveys certain meanings:

> Where and when a teacher chooses to travel in a classroom signifies meaning. In the past, teachers moved around their desks as if they were isles of security. They rarely ventured into the territories of student residence unless they wished to check or monitor seat work. To move forward or away from students signifies relationships. Distances establishes the status of interaction. (p. 9)

[1] The researcher re-ranked Davis's rankings to use the same ranking procedure used by Teachout. Accordingly, the ranks described here are different than originally reported by Davis.

Although Galloway is writing about general education classrooms, parallels with traditional large ensemble classrooms are apparent. For example, large ensembles are often organized with clearly delineated "student" and "conductor" spaces. Unless ensemble setups are specifically organized to allow conductors and teachers to move among their students, teachers may rarely enter this "student space."

Taking together the dearth of music education research exploring issues of proximity and teacher use of space, educators who may be unaware of their proximity and their mobility, and the insights provided by Galloway, there may be important implications for large ensemble teachers regarding the organization of our classrooms and the use of space by teachers.

Review of Literature

No known research in music education has specifically explored issues of classroom organization or teacher use of space in regards to teaching and learning. Rather, these issues have been raised indirectly through broader investigations of nonverbal behaviors. Presented in this literature review are four explorations of nonverbal behaviors in music contexts, highlighting their implications for use of space. Two examples from general education research are also presented for additional context and implications for use of space.

Byo and Austin (1994) sought to compare the nonverbal behaviors of both novice (n = 6) and experienced university band conductors (n = 6). Specifically, Byo and Austin documented right arm/hand gestures, eye contact, facial expression, and body movement. Pertinent to the present study, body movement consisted of two subcategories: (1) "expressive" which "included but [was] not limited to turns toward a group of performers, forward leans, and movement that resulted from bending the knees," while the (2) "static" subgroup was defined as "stationary,

stick figure-like" (p. 20). Byo and Austin found statistically significant differences between novice and expert conductors in regards to expressive ($p < .05$) and static ($p < .01$) body positions. Expert conductors spent a greater percentage of time using expressive movement (M = 65.17, SD = 23.10) and less time using static position (M = 31.67, SD = 22.33), than novice conductors (M = 31.67, SD = 13.50; M = 67.67, SD = 12.53, respectively).

Byo and Austin (1994) do not provide details about the frequency of specific expressive body movement behaviors (turns towards performers, forward leans, bend at knees). Accordingly, further implications of these behaviors are unknown. Additionally, these behaviors might be characterized as body movement behaviors limited to those occurring on the podium. In contrast, Yarbrough (1975) provided a slightly more expansive understanding of conductor movement.

Yarbrough (1975) sought to explore the effect of "conductor magnitude" on 207 students' performance, attentiveness, and attitude in mixed choruses. Operational definitions for low and high magnitude for each of six behaviors—including eye contact, closeness, volume and modulation of voice, gestures, facial expressions, and rehearsal pace—were created. Related to the present study, a conductor with high magnitude closeness was defined as one who "frequently walks or leans toward chorus or particular section," whereas a conductor with low magnitude closeness was one who "stands behind music stand at all times. Music stand is always a minimum of four feet from chorus" (p. 138). The students rehearsed with a "regular" conductor, a high magnitude conductor, and a low magnitude conductor. Yarborough noted that the conductors "spent most of their time behind the music stand rather than moving toward the chorus or walking among the students during rehearsal" (p. 144), but that the high magnitude conductors "had significantly more approach movement" (p. 145).

In this case, Yarbrough conceived of closeness as frequencies of "approach," "departure," and "stationary" behaviors. Unfortunately, Yarbrough does not define these terms, describe precisely how they were counted, nor provide any detailed statistical information with one exception: "The mean frequencies of the subcategories of body movement under the high magnitude condition are: Approach—17.00; Departure—5.75; Stationary—43.25" (p. 145). It appears that even in the high magnitude condition, the conductor was largely stationary.

While Byo and Austin (1994) and Yarbrough (1975) sought to quantify certain nonverbal behaviors, including expressive body movement and closeness of conductors, Kurkul (2007) sought to quantify similar behaviors in the context of studio lessons. Kurkul (2007) studied nonverbal communication behaviors among 60 college teachers and 60 non-music major students in one-to-one music lessons. The specific behaviors explored by Kurkul included eye contact, facial expression, hand gestures, forward leaning, head nodding, physical distance, touching, silence, and voice quality. Among these behaviors, issues of space and proximity might be captured by forward leaning (measured in frequency and duration), touch (measured in frequency), and physical distance (measured as an average of estimated inches over the course of a lesson) behaviors. Exploring the relationships between these three behaviors and the student evaluations of their teachers, a small significant correlation between forward lean frequency and rapport was found ($r = .27$, $p < .05$). No other significant relationships were found between these three behaviors and the other evaluation elements including communication, pedagogical skill, instructional organization, and general instructional competence.

Levasseur (1994) sought to understand how nonverbal communication in studio teaching impacts student learning. Her qualitative study explored touch, facial expression, eyes, posture, pacing, expressive movement, and space among voice teachers. Specific to the use of space,

Levasseur noted that the use of space within the studio was influenced by issues like the size of the studio and the size of the piano, and that the piano "created a barrier between the student and teacher" (p. 85). Generally, teachers tended to stay behind the piano and students tended to stay within the space opposite the teacher. Based on her observations of space, Levasseur developed several interesting conclusions. She wrote:

> Space is territory which a teacher uses to allow or deny access. Invasion of space can symbolize a predatory stance. In some cases, space can show respect or privacy. Space can indicate to a student that the teacher is aloof and uncaring. (Again, the use of space is idiosyncratic in terms of teacher-student relationships.)… Students in the studio were sensitive to teachers' use of space. One student stated: "I recall that a poor teacher used to sit on the opposite side of the room from me, distant and reserved. My best teacher shared the room with me. He was near enough to seem caring without ever violating my space." (pp. 112-113)

Taking the work of Byo and Austin (1994), Yarbrough (1975), Kurkul (2007), and Levasseur (1994) together, several implications for music teaching and learning seem apparent. This research suggests that expert and high magnitude conductors may tend to be more dynamic and expressive with their bodies, including greater more use of turns toward a group of performers, forward leans, movement that resulted from bending the knees, and more approaches toward ensembles. Additionally, in some contexts, lean-forward behaviors by teachers are positively correlated with rapport. Finally, implications surrounding issues of perceived "territory" and "invasion of space" may also be worth further consideration in some musical contexts.

Two studies of teacher use of classroom space in the general education literature provide additional important implications. These studies also informed the development of the measure in the present study. Hesler (1972) studied relationships among "instructor's spatial behavior, the interpersonal relationship of teacher to pupil, personality characteristics, sex of instructor, and seating arrangements" of 24 instructors and 452 students from "speech-communication" courses (p. vii). Hesler's measure of interpersonal relationships contained "the basic needs of inclusion, control, and affection [that] seem to arise continually in studies of interpersonal relationship[s]" (p. 29). To collect data pertaining to teacher's use of space, she divided the classroom into six distinct zones of the classroom: (1) at or near the front wall or blackboard, (2) on, beside, or behind the teacher desk, (3) in front of the teacher desk, (4) along either side of the room, (5) at the back of the room, or (6) among the students. Every 30 seconds, or whenever the instructor changed zones, Hesler tallied the teacher's location. Additionally, classrooms were categorized as either traditional (e.g., chairs in rows and columns) or non-traditional (e.g., chairs arranged in circles, horseshoes, etc.) setups.

Hesler found positive correlations between the "student affection" factor and the "among the students" zone ($r = 1.00$, $p < .05$) and between the "inclusion" factor and the "in front of the teacher desk" zone ($r = .40$, $p < .05$). In contrast, negative correlations between the "on, beside, or behind the teacher desk" zone and both "teacher affection" ($r = -.47$, $p < .05$) and "inclusion" ($r = -.59$, $p < .05$) factors were found. No significant relationships between teacher personality and instructor use of space were found. Additionally, no significant relationships between interpersonal relationship or personality and use of traditional or non-traditional setups were found.

Specific to issues of physical space, Martin (2002) sought to understand (a) how classrooms were being used throughout a given lesson, (b) to what extent teachers are in control of the classroom physical environment, and (c) if it is possible to improve the design and use of classroom spaces. Martin's study was extensive and covered 12 constructs related to teaching and the classroom space, but most pertinent to the present study, Martin explored mobility (total area covered by the teacher in square meters over the course of a lesson) and interactions (the whole group of students; small group; individual students; other individuals such as visitors; or no interaction). In total, Martin observed 61 lessons in 12 schools with 39 different teachers. Martin (2002) found a negative correlation between teacher mobility and whole group interactions ($r = -.42$, $p < .05$) and a positive correlation between teacher mobility and group and individual interactions ($r = .41$, $p < .05$).

Reviewing the results of music education research and general education research together, implications for developing a measure of teacher mobility in large ensembles emerge. The behaviors described by Byo and Austin (1994) and Yarbrough (1975) constrain teacher mobility to on or near the podium. While this may have been the extent of the observed behaviors in those studies, they do not capture total possible movement by teachers, including those teachers who move toward and among students or teachers who may occasionally occupy other areas of the classroom, as described by Hesler (1978) and Martin (2002). Without richer details about these physical aspect of teaching, possible implications for teachers, conductors, and students is limited. Accordingly, a measure that captures wider possibilities for teacher mobility is warranted, like Hesler's use of classroom zones. This is also suggested by Yarbrough (1978) who noted:

> Future research might focus on increasing the variety of conductor behaviors within each category or the isolation of specific categories of behavior. Varying conducting behavior by going from one extreme to another, i.e.,… much body movement to no body movement… might yield interesting results. (p. 145)

Additionally, a measure that captures the relationship between teacher use of space and other teaching or learning outcomes is also warranted. Kurkul (2007) makes a similar recommendation:

> While collecting data and videotaping lessons, the researcher noticed that some teachers changed their locations very frequently, while some barely moved. This difference existed particular between different performance media, since for some instruments such as double bass, guitar, and piano the instrument was a barrier to instructor mobility. In others (e.g. voice), teacher mobility was much more evident. This variable ["teacher mobility within the lesson"], therefore, may have an impact on the evaluation of lesson effectiveness or relationship with teachers' nonverbal sensitivity. Inclusion of this variable in future research is strongly recommended. (pp. 358 – 358)

Purpose & Research Questions

The primary purpose of this study was to design a continuous time-coding tool for measuring (1) the amount of time teachers occupy certain locations of the large ensemble classroom, and (2) the verbal and musical interactions of teachers (understood as interactions with an individual student, interactions with groups of students, whole group interactions, other interactions, and no interactions). A secondary purpose was to investigate the effect of a brief intervention with preservice teachers working with a middle school band. The intervention

sought to provide the teachers with strategies for teaching off or away from the podium and toward or among students. The questions guiding this study included:

1. Can a researcher-created observational tool measure ensemble teacher use of classroom space and classroom interactions in a valid and reliable manner?
2. What is the effect of a brief expository lesson on teachers' use of classroom space on preservice instrumental music teachers' use of classroom space and proximity?

Method

Participants

The participants in this study included 12 undergraduate music education students—primarily sophomores and juniors—completing a practicum requirement in Spring 2016. The practicum experience was offered by the school of music and the music education department at a large midwestern university. The practicum experience was designed to provide instrumental music education majors with the opportunity to teach middle school students from communities surrounding the university. The program met on Saturday mornings for two hours and ran for 11 weeks; consisting of ten rehearsals and one performance. The undergraduate students served as teachers (and described as “teachers” hereafter) in the program and taught both small group and large ensemble lessons to the participating middle school students. The middle school students (described as “students” hereafter) were divided into two bands, advanced and beginning, with approximately 20 students in each band and six teachers assigned to each band. Each teacher was assigned a piece of music to teach to their respective ensemble. The researcher served as program coordinator—primarily providing organizational leadership for the program, reviewing

teacher lesson plans, and providing feedback to the teachers about their teaching episodes (e.g. issues related to sequencing, assessing learning, pacing, effective feedback, etc.).

Instrument Design

The instrument designed in the present study was primarily influenced by Hesler (1972) and Martin (2002). Hesler divided the general education classroom in her study into six areas including (a) "at or near the blackboard or front wall of the classroom," (b) "at or near his desk, lectern, or table," (c) "in front of the desk… or a table within five feet or less of the nearest student," (d) "along either side of the classroom," (e) "at the back of the room," and (f) "among or within the students" (1972, pp. 23-24). Similarly, the present tool divides the ensemble classroom into 14 "Classroom Zones," including: (a) at the board, (b) behind the podium, (c) left and away from the podium, (d) left of the podium, (e) on the podium, (f) right of the podium, (g) right and away from the podium, (h) front of the podium, (i) in the aisle, (j) in a row, (k) seated in a student chair, (l), left and behind the students, (m) directly behind students, and (n) right and behind the students. In contrast to Hesler, whose tallied teacher location every 30 seconds, the present measure uses continuous time coding in order to determine the amount of time the individual remains in a particular zone.

Martin's (2002) approach to measuring teacher interactions was influential as well. Her study included five types of interactions: (1) whole group, (2) group of students, (3) individual student, (4) other individual, including visitors or observers, and (5) no interaction. These same five categories were preserved for use in the present tool. In order to provide greater detail about the nature of the teacher-student interactions, the present tool allowed for these "Teacher Interactions" to be marked as either verbal interactions or musical interactions. For example,

"whole group" verbal interactions included instances where teachers taught or spoke to the entire group. In contrast, "whole group" musical interactions included instances where the teacher was conducting the whole ensemble.

The measure was created in Scribe 4.2 (Scribe 4 Software, n.d.) and is presented in Figure 1. Each of the colored boxes were clickable buttons. When teachers entered a particular Classroom Zone or began a specific type of Teacher Interaction, the rater/observer clicked the corresponding button and Scribe collected frequency and duration data for that zone or interaction. Frequency and duration data for each zone and each interaction were the data used in the present study.

Establishing validity. The initial design of the measurement tool in the current study was created based on the researcher's personal experience and expertise in pedagogy relevant to band contexts as well as by consulting previous research (Hesler, 1972; Martin, 2002). The researcher adapted Hesler's notion of classroom zones and Martin's types of teacher interaction to be consistent with typical large ensemble instruction. For example, where Hesler refers to the teacher's desk, the present tool refers to the podium; whereas Martin only included verbal interactions between teachers and students, the present tool includes both verbal and musical interactions.

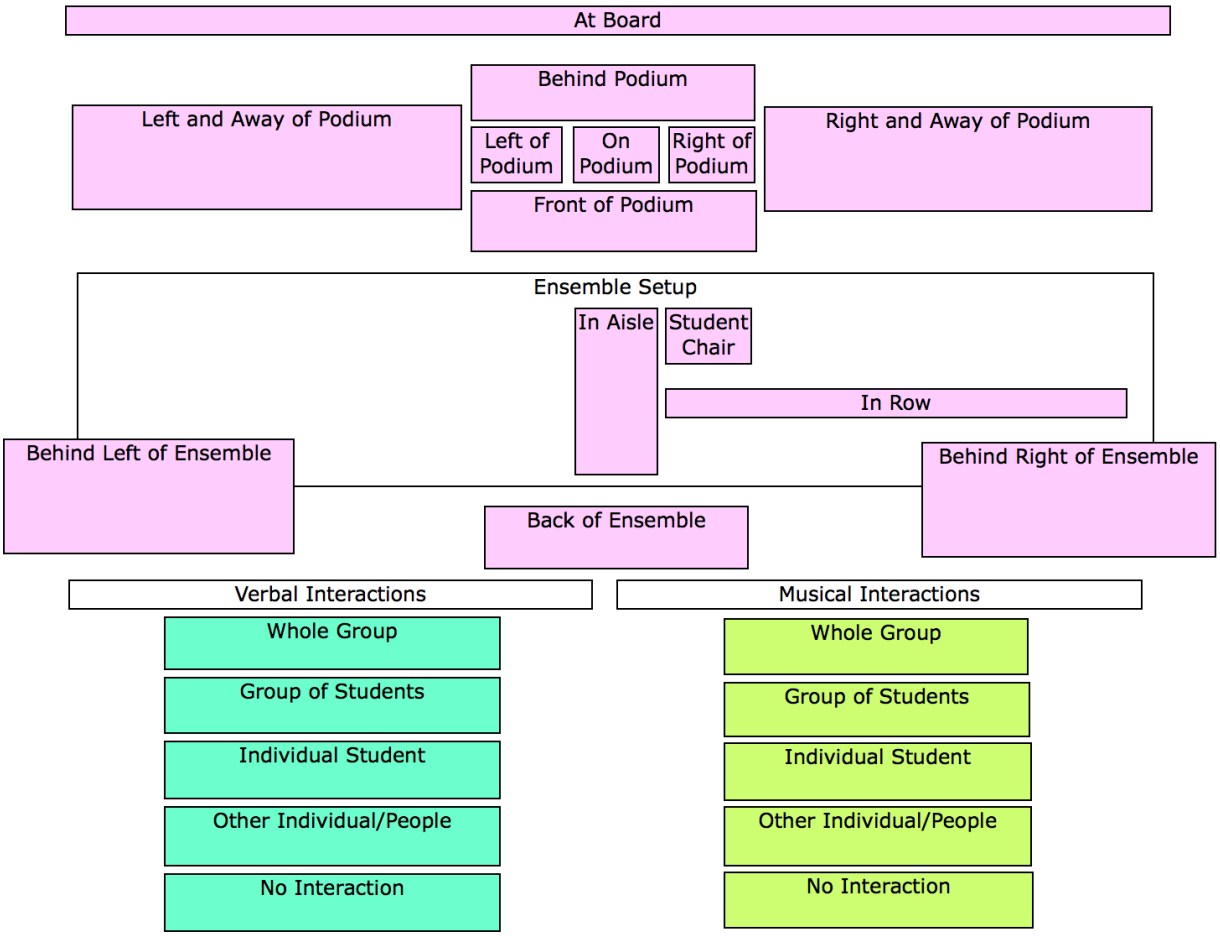

Figure 1. Measure designed in the present study as seen in Scribe 4.2

An early version of the tool was presented to four experienced instrumental educators and they were asked to verbally describe the tool. Any misunderstandings were noted and clarified. The purpose of the tool was then explained, and any concerns or suggestions were also noted and clarified. For example, some concern was expressed about the difference between zones like “Left of Podium” and “Left and Away from Podium,” or differences between the “Behind Podium” and “At Board” zones. “Left of Podium” was clarified to mean that the teacher simply stepped off and to the left of podium, whereas “Left and Away from Podium” was understood as taking more than one step and moving away from the podium. “At Board” was clarified to include instances where the teacher moved behind the podium to specifically interact with the board (e.g., pointing to something written on the board), whereas “Behind Podium” was

understood as simply occupying the space directly behind the podium without interacting with the board. After addressing these concerns, the educators noted the tool would accurately capture the intended data.

Procedure

All ten of the two-hour rehearsals were divided into 90 minutes of large ensemble teaching and 30 minutes of small group lessons. Both bands rehearsed at the same time in different rooms, and the six teachers assigned to each band taught their individual large ensemble lessons during the 90-minute rehearsal. The 90 minutes were typically divided evenly across the six teachers in each rehearsal (approximately 15 minutes for each lesson). Both simultaneously-occurring 90-minute rehearsals were video recorded for all ten weeks of the program. The HD camera (JVC GZ-VX815) was positioned at approximately eye-level at the back of the ensemble facing toward the front of the classroom to capture most of the room. An intervention was presented between weeks five and six of the study.

Intervention

To explore the secondary purpose of the present study, a single interrupted time series design was used. Specifically, the teachers were observed during weeks one through five, an intervention was presented after week five, then the teachers were observed five more times during weeks six through ten. The intervention consisted of a brief expository lesson, in which the researcher described various ensemble setups and strategies for using space toward and among students while teaching (e.g., strategies for using the aisle space while teaching). Further, a brief review of pertinent research from general education literature was described to further

impress the value of using proximity while teaching. For the duration of the study, the ensemble setup included an aisle down the center of the ensemble extending through the percussion section located in the back. The purpose of this aisle was to allow teachers to move toward and among students as needed or necessary.

Data Analysis

Rehearsals from weeks three, five, six, and eight were ultimately selected for analysis. Rehearsals from weeks one, two, nine, and ten were not considered because they were less likely to reflect the participants' typical band rehearsal behavior. For example, teachers and students were "getting into a routine" during weeks one and two of the program. During weeks nine and ten, teachers began shifting their lessons from specific "micro-level" concerns (e.g., specific rhythms, pitches, concept-learning, etc.) toward final "macro-level" concerns (e.g., complete run-throughs of their pieces) for the performance during week 11. It is also important to note that the amount of real time between weeks six and eight of the program was not two weeks, but four weeks due to spring break at the university.

In total, 45 lessons (each approximately 12 – 15 minutes in length) during the four selected weeks were included for analysis. Establishing reliability of the tool using these selected videos is described in the results section of this article. To explore the impact of the intervention, the researcher used the tool developed in the present study to collect frequency and duration (in seconds) data from all 45 lessons. Specifically, 11 lessons from week three, 11 lessons from week five, 11 lessons from week six, and 12 lessons from week eight. In order to ensure proper coding, each lesson was viewed twice.

Results

Establishing Reliability

A total of five teacher lessons (about 10% of the total video data used in this study) from the 45 lessons were selected and independently reviewed by both the researcher and a second rater to establish reliability. Specifically, one teacher lesson was randomly selected from each of the four weeks, and one was randomly selected from all four weeks. After a brief training session on using the Scribe tool, the second rater reviewed the five lessons using the tool. Several steps were undertaken to compare the data between raters, including a visual inspection of the timelines produced by Scribe as a product of the continuous time-coding procedure, calculation of inter-rater reliability, and a detailed comparison of each element (including the classroom zones and verbal and musical interactions) between raters.

Visual inspection of timelines. In addition to producing data in the form of frequencies and time durations of events, Scribe produces visual timelines that display the events as indicated by the rater. The purpose of visually inspecting the timelines was to ensure an overall level of consistency in the use of the tool and to note any significant discrepancies between raters. An example of these timelines is presented in Figure 2.

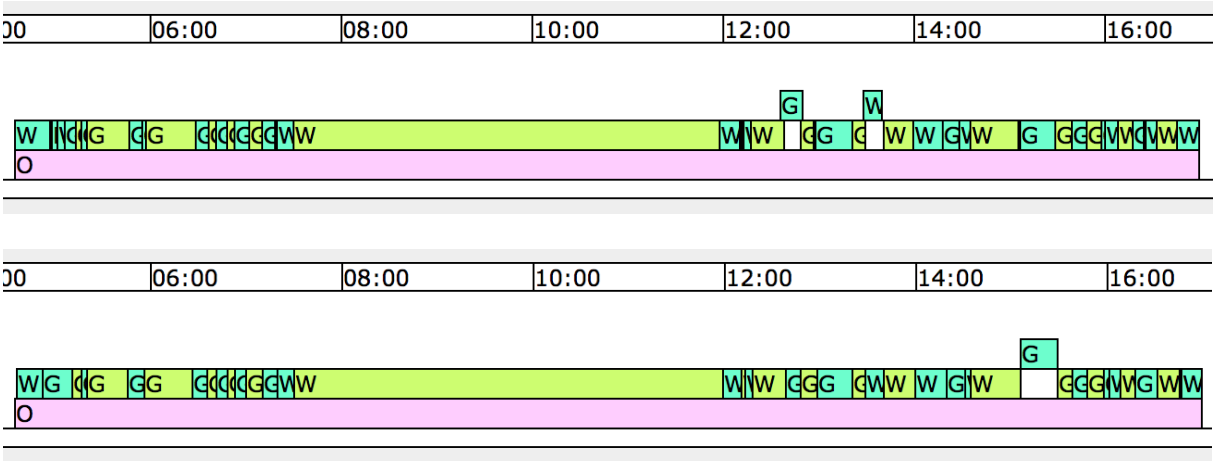

Figure 2. An example of Scribe timelines from each rater displaying similar timing and duration of independently-coded events from selected lesson.

Both timelines (one from each rater) for each of the five videos were presented to the second rater for independent review. The second rater concluded that there did not appear to be any significant discrepancies between any pair of timelines.

Inter-rater correlations. Spearman correlation analyses were also performed to establish a more objective assessment of reliability. Inter-rater reliability was calculated for the tool's seven individual components: (1) classroom zones by frequency, (2) classroom zones by duration in seconds, (3) classroom zones by both frequency and duration, (4) teacher interactions by frequency, (5) teacher interactions by duration, (6) teacher interactions by both frequency and duration, and (7) both classroom zones and teacher interactions by both frequency and durations. The total number of comparisons between raters for each of the seven components ranged between 50 and 240. For example, one rater's data related to "classroom zones by frequency" for one lesson resulted in 14 data points (i.e., the number of times a teacher occupied each of the 14 identified zones). Across five lessons, this produced 70 data points from each rater. The 70 data points from each rater were correlated to establish inter-rater reliability for "classroom zones by frequency." The same procedure was used for each of the seven components. Inter-rater reliability coefficients for all seven components of the tool was found to be greater than .79. Reliability coefficients and number of inter-rater comparisons for each component is presented in Table 1.

Table 1

Inter-rater Reliability Coefficients for Components of the Measure (Number of Comparisons)

Measure Components	Classroom Zones	Teacher Interactions	Zones and Interactions
Frequency	.798 (70)	.964 (50)	
Seconds	.828 (70)	.963 (50)	
Frequency and Seconds	.795 (140)	.946 (100)	.890 (240)

Note. All correlations $p < .01$.

Examining zones and interactions. To further explore inconsistences between raters, with particular interest in frequencies related to classroom zones where inter-rater reliability was the lowest, frequency and duration data for each of the 14 zones and 10 interactions were examined (see Table 2 and Table 3). Regarding classroom zones, the zones with the greatest frequency discrepancies were At Board, Behind Ensemble, Behind Podium, and Aisle. Similarly, the greatest duration discrepancies were the At Board, Behind Ensemble, Behind Right of Ensemble, Behind Podium, and Right and Away from Podium zones. For teacher interactions, the interactions with the greatest frequency and duration discrepancies were Group of Students (Verbal), Other(s) (Verbal), and Whole Group (Musical). It should be noted that the single greatest discrepancy in frequency was a difference of five for "At Board"; this represents an average frequency discrepancy of one per lesson observed. Similarly, the greatest duration

Table 2

Frequency and Duration Data Across Five Lessons for Classroom Zon

Classroom Zones	Frequencies		
	Rater #1	Rater #2	Diff
Periphery Locations			
At Board	8	13	-5
Behind Left of Ensemble	0	0	0
Behind Ensemble	4	0	4
Behind Right of Ensemble	1	0	1
Podium Locations			
Behind Podium	7	10	-3
Left of Podium	0	2	-2
On Podium	10	11	-1
Right of Podium	13	14	-1
Front of Podium	7	7	0
Left and Away of Podium	1	1	0
Right and Away of Podium	2	1	1
Within Locations			
Aisle	8	4	4
Row	0	1	1
Chair	0	0	0

* *Note*. "Diff" is the difference between Rater #1 and Rater #2; "% Agree" is equal to

Table 3

Frequency and Duration Across Five Lessons for Teach

Teacher Interactions	Fr	
	Rater #1	Rater #2
Verbal Interactions		
Whole Group	88	86
Group of Students	56	59
Individual Student	34	34
Other(s)	2	7
No Interaction	4	5
Musical Interactions		
Whole Group	64	61
Group of Students	35	37
Individual Student	4	3
Other(s)	0	0
No Interaction	0	0

* *Note*. "Diff" is the difference between Rater #1 and Rater #2; "%

discrepancy among all categories was 36.30 seconds, which represents less than 1% of the total time reviewed in the videos.

Effect of Lesson on Teacher Use of Space

The secondary purpose of the study was to explore the effect of a brief expository lesson on teachers' use of classroom space on preservice instrumental music teachers' use of classroom space and proximity. The measure in the present study was used to analyze 45 lessons selected from four weeks of the practicum program. Each lesson was approximately 12-15 minutes in length, resulting in approximately 150 minutes of lessons from each week. The intervention took place between weeks five and six.

Data from weeks three and five were collapsed into “pre-intervention” data, while data from weeks six and eight were collapsed into “post-intervention” data. Mean seconds of time spent in most classroom zones increased from pre- to post-intervention, except in At Board, Row, and On Podium zones. For At Board, Row, and On Podium zones, mean seconds of time spent in these zones decreased during the post-intervention period. Descriptive statistics for student pre- and post-intervention by classroom zones and teacher interactions are presented in Tables 4 and 5 respectively.

To determine if there were any significant differences in time for podium use and moving toward or among students, several analyses were used to compare (a) pre- and post-intervention times, and (b) differences in times over the four weeks. Zones considered most pertinent to understanding changes in podium time and moving toward or among students were the duration data for Podium, Front of Podium, and Aisle zones. These zones were examined because they are most closely related to the purpose of the intervention: for teachers to spend less time on the

podium and more time moving toward and among students. Wilcoxon Signed Ranks test resulted in a significant difference between pre- and post-Podium zone times (Z = -2.31, p = .02), while differences for Front of Podium and Aisle times were not significant. Over the four observed lessons, Friedman tests revealed no significant difference for Podium time, but significant differences for Front of Podium and Aisle (see Table 6). As seen in Table 6, there is a decrease in time for Podium and increase for Front of Podium and Aisle during Week 6 (the lesson immediately following the intervention), but a return to pre-intervention levels during Week 8.

Table 5

Pre- and Post-Intervention Duration Data for Teacher Interactions

Teacher Interactions	Pre-Intervention			Post-Intervention		
	M	*SD*	Skew	*M*	*SD*	Skew
Verbal Interactions						
Whole Group	279.14	69.52	0.45	215.95	71.63	0.87
Group of Students	137.46	79.01	0.55	107.26	75.13	0.58
Individual Student	21.05	20.97	1.03	25.33	39.92	2.23
Other(s)	8.75	36.01	4.61	0.72	2.46	3.46
No Interaction	6.37	13.67	2.34	19.40	47.50	2.53
Musical Interactions						
Whole Group	251.60	101.46	0.58	269.26	98.57	0.09
Group of Students	71.89	58.15	0.57	61.80	53.23	0.58
Individual Student	0.72	2.44	3.51	4.46	10.85	2.63
Other(s)	0.00	0.00	0.00	0.00	0.00	0.00
No Interaction	0.00	0.00	0.00	0.66	3.16	4.79

Note. All duration data presented in seconds.

Relationships between classroom zones and teacher interactions during both the pre- and the post-intervention periods was also explored. Spearman correlations between zones and interactions resulted in 12 correlations that were significant during the pre-intervention period, but were not significant during the post-intervention period. These correlations are presented in Table 7.

Table 6

Friedman Analyses for Selected Classroom Zones Over Time

Classroom Zone	*M*	*SD*	Mean Rank	χ^2	*p*
Podium					
Week 3	666.11	103.07	2.44		
Week 5	800.18	229.97	3.00		
Week 6	556.81	143.39	1.78		
Week 8	703.74	153.58	2.78	4.60	.204
Front of Podium					
Week 3	9.83	20.00	2.72		
Week 5	1.27	1.99	2.00		
Week 6	31.28	63.45	3.44		
Week 8	2.48	5.85	1.83	10.74	.013
Aisle					
Week 3	12.21	18.91	2.83		
Week 5	6.16	9.79	2.33		
Week 6	44.77	83.03	3.06		
Week 8	0.75	2.26	1.78	7.98	.046

Table 7

Pre-Intervention Spearman Correlations between Classroom Zone and Teacher Interactions

Zone and Interaction	*r*	*p*
At Board and Group of Students (Verbal)	-.45	.03
At Board and Group of Students (Musical)	-.44	.03
Behind Left of Ensemble and No Interaction (Verbal)	.46	.03
Behind Ensemble and No Interaction (Verbal)	.46	.03
Left and Away of Podium and Group of Students (Verbal)	-.51	.01
On Podium and Group of Students (Verbal)	.51	.01
On Podium and Individual Student (Verbal)	-.62	.002
On Podium and Group of Students (Musical)	.60	.003
Front of Podium and Individual Student (Verbal)	.48	.02
Front of Podium and No Interaction (Verbal)	.56	.006
Aisle and Individual Student (Verbal)	.56	.006
Aisle and No Interaction (Verbal)	.67	.001

In contrast, just three correlations were significant during the post-intervention period, but not the pre-intervention period: (a) Behind Right of Ensemble and No Interaction (Verbal) (r = .48, p = .02), (b) Left of Podium and No Interaction (Verbal) (r = .52, p = .01), and (c) On Podium and Whole Group (Musical) (r = .45, p = .02). There was one significant correlation in

both conditions between Left and Away of Podium and No Interaction (Verbal): pre-intervention (r = .51, p = .01) and post-intervention (r = .56, p = .005).

Discussion

The primary purpose of this study was to design a continuous time-coding tool for measuring (1) the amount of time teachers occupy certain locations in the classroom, and (2) the verbal and musical interactions of teachers. A secondary purpose was to investigate the effect of a brief intervention with preservice teachers working with a middle school band. The intervention sought to provide the teachers with strategies for teaching off or away from the podium and toward or among students. The questions guiding this study included: (1) Can a researcher-created observational tool measure ensemble teacher use of classroom space and classroom interactions in a valid and reliable manner? and (2) What is the effect of a brief expository lesson on teachers' use of classroom space on preservice instrumental music teachers' use of classroom space and proximity?

Strong content validity was established by basing the measure on observation schemes shown to be valid in general education literature (Hesler, 1974; Martin, 2002), by making specific adaptations of existing measures based on practitioner experience and content knowledge, and by consulting a panel of independent content experts who further refined the tool. The present tool was also found to measure teacher use of classroom space in a reliable manner. Specifically, independent visual review of the Scribe timelines, inter-rater reliability coefficients above .79 with the overall measure above .89, and inspection of all 24 elements in the measure (including both frequency and duration discrepancies for the 14 zones and 10 interactions) all demonstrate good overall reliability.

The measure and its use can be improved in several ways. During the training session for the second rater, differences in opinion between the raters most frequently occurred when the participant approached a boundary between two zones (e.g., Front of Podium and Aisle). Specifically, due to the camera's video quality, height, and distance from the participants, it was sometimes unclear which zone the participants were located in. This appears to be a source of error for the present study for classrooms zones. Accordingly, future researchers are advised to use a camera that produces high quality wide-angle images and to station the camera sufficiently high. Whereas the camera in the present study was located at approximately eye level, a camera that is mounted significantly higher (e.g., from the ceiling) will likely add additional clarity and reliability.

Regarding teacher interactions, the item with the greatest error and requiring clarification in the future was Other(s) (Verbal). In one of the videos used to establish reliability, a teacher was seen interacting with another teacher who was seated with students and playing to support the section. One rater marked this interaction as Individual Student (Verbal) while the other rater indicated Other(s) (Verbal). Accordingly, further development of the measure could entail clarifying who constitutes as "Other" more clearly.

In relation to the effect of the brief expository lesson on usage of classroom space, the lesson appears to have been effective only short-term. Specifically, students spent less time on the podium and more time occupying some classroom zones, including the Front of Podium and Aisle zones. However, these changes in movement were largely constrained to the lesson immediately following the intervention (see Table 6, Week 6) and students appeared to return to similar levels of behaviors observed during the pre-intervention period (Week 8).

Correlations between classroom zones and teacher interactions revealed numerous relationships during the pre-intervention period. For example, relationships between both Aisle and Front of Podium zones and Individual Student interactions were positively correlated, while On Podium zone and Individual Student interactions were negatively correlated. This suggests that teachers were more likely to interact with individuals when off the podium than when on the podium. Interestingly, in contrast to 12 significant correlations between classroom zones and teacher interactions during the pre-intervention period, there were just three significant correlations during the post-intervention, and only one significant correlation between both periods. These results—combined with a return to pre-intervention levels during week eight—may reflect students' learned behaviors and habits regarding how they occupy space and with whom they interact in those spaces. It appears that the intervention used in the present study was not sufficient for creating any lasting change in most students' behaviors.

Limitations

The investigation of the brief intervention in the present study was largely exploratory in nature and design, and its conclusions are further constrained by several issues. First, the design was a single interrupted time series design without a comparison group, which is prone to threats to internal validity (e.g., maturation and history). Second, and related to internal validity, a return to pre-intervention behaviors during week eight may be attributed to the natural progression of the practicum program. By week eight of the program, the lessons began shifting from micro-level concerns (e.g., teaching of specific musical concepts) to macro-level ones (e.g., run-throughs of the music). These changes in instruction were likely to impact the teachers' interactions and use of space.

Future Research

It would be beneficial if future research efforts were focused on exploring additional adaptations of the tool developed in the present study. The ensemble setup used with the teachers in the present study remained consistent throughout the duration of the practicum, and the tool was designed to fit the specific setup used in this practicum. Researchers may wish to explore whether the tool can reliably be extended to other setups. Alternatively, establishing criterion validity may be an insightful addition to the tool. For example, Hesler (1974) argued for construct validity of her measure by conceiving of "near" and "distant" categories, based on a "social distance" construct (Hall, 1966). Constructs like "near" and "distant" social distances may have important implications for ensemble teachers in regards to rapport with students and could prove to be a beneficial addition to the tool. It would be valuable to see whether measures of teacher use of space could be predictive of such psycho-social constructs.

Presented in the literature review was a critique of existing efforts to measure proximity in music education. One component of this critique was that the degree of proximity-related behaviors explored was relatively constrained. It might be argued that this tool is too blunt, as it is unable to discern more nuanced proximity-related behavior like "lean forward." While the present tool expands possible proximity-related behaviors to the entire classroom space, it cannot capture more subtle behaviors like "lean forward" as-is. Future researchers may wish to explore adding more "fine-tuned" proximity behaviors to the measure.

The exploration of teacher use of space in large ensemble settings could also provide many research opportunities. Research in general education exploring the effect of classroom setup and teacher use of space on various student outcomes is prolific, while similar research does not appear to exist in the music education literature. Accordingly, the effect of teacher

movement and ensemble setup on student affect, motivation, and classroom environment might have important implications for large ensemble teaching and learning.

This study resulted in a reliable and valid tool for measuring teacher use of space and teacher interactions. Further development of the tool and its use in future studies to explore the relationship between teacher use of space and other teacher or student outcomes is recommended. The intervention used in the present study seemed to temporarily influence teachers' proximity and use of space behaviors. However, the intervention can be improved and further exploration of teacher attitudes and perceptions of use of space when teaching is also warranted.

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