Looking Is Not Seeing and Listening Is Not Hearing: A Replication Study With Accelerated BSN Students

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Development of perceptual aptitude is a critical yet complex skill that requires the effective organization and interpretation of data using visual and auditory clinical observation. Educators face challenges in creating pedagogy that consistently demonstrates reliability and validity in fostering clinical skills. We have dependably used the arts as a means to improve students' auditory and visual skills, and this article will describe replication of our work with accelerated nursing students in a bachelor's program in their last semester of nursing school (n = 23). Our results reveal that auscultative and observational abilities of soon-to-be registered nurses are in need of improvement. The use of art in a museum improves observational and assessment abilities, and music training increases auscultative interpretive skills significantly. (Index words: Nursing education; Art; Music pedagogy) J Prof Nurs 0:1–7, 2016.

Background

Clinical observation is an essential skill for nursing practice. Students are tasked with developing this capability throughout their career and, with practice, can improve over time. As the health care environment becomes more complex, it is ever more important for providers to be holistically minded and creative problem solvers, with keen perceptual and communication skills.

Previous study of the use of art and music in graduate nursing education demonstrated marked improvement in perceptual skills of observational and auscultative abilities (Pellico, Duffy, Fennie, & Swan, 2012; Pellico, Friedlaender, & Fennie, 2009; Pellico et al., 2013). The question of the pedagogy's portability prompted this replication study in an accelerated bachelors of nursing (BSN) student population.

The humanities are recognized as a valuable element of nursing education. The Essentials of Baccalaureate Education for Professional Nursing Practice (2008) acknowledges "a solid base in liberal education provides the cornerstone for the practice and education of nurses" (p. 11). Although art and music are liberal study disciplines that have not traditionally been part of nursing education, they bring a new lens through which students can learn valuable skills. In addition to skill acquisition, the nontraditional format may provide avenues to think critically, opening the mind to alternative ways of seeing and hearing (McKie, 2012). Yet, tradition has a firm grip on nursing education. A faculty survey in 2006 found that nursing programs are highly structured, faculty feel pressure to cover content, and lecture is the prevailing classroom instructional strategy (Pardue, 2006). The question is how to advance a new pedagogical climate that includes creativity, risk taking, curiosity, and cooperation between students and faculty.

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Looking at fine art enhances nursing students' abilities to observe and understand clinical situations (Klugman & Beckmann-Mendez, 2015; Baumann, Murphy, & Ganzer, 2015; Delaney, 2006; Frei, Alvarez, & Alexander, 2010; Friedlaender & Friedlaender, 2013; Grossman, Deupi, & Leitao, 2014; Hoshiko, 1985; Karkabi, Wald, & Cohen Castel, 2014; Klugman & Beckmann-Mendez, 2015; McKie, 2012; Pardue, 2005; Pellico et al., 2009, 2012, 2013; Rieger & Chernomas, 2013; Uppal, Davies, Knowles, & Kandell, 2014). Art as a teaching tool increases students' reflective abilities, empathy, communication skills, and sensitivity toward patients (Uppal et al., 2014; Wikstrom, 2003; Wikstrom, 2011; Wikstrom & Sviden, 2005, 2007).

Guided listening to music is less commonly found in the literature as a tool to improve students' abilities. Our previous work with auditory skill training successfully increased skill and sensitivity in hearing and interpreting sounds relevant to diagnostic auscultation (Pellico et al., 2012). Specifically, the ability to label normal and abnormal heart sounds doubled; interpretation of normal and abnormal lung sounds improved by 50%; and bowel sounds interpretation improved threefold, confirming the positive effect of an adult-oriented, creative, and practical method for teaching auscultation. This study examined whether the fine art and music pedagogy used previously for accelerated master's nursing students could be applied to accelerated bachelor's nursing students and whether it significantly improved their physical assessment and auscultative skills.

Research Approach and Methodology

Participants

A pretest–posttest design was used to evaluate the effectiveness of the art and music program. The sample consisted of 23 students in their third and final semester of an accelerated BSN program for nonnursing college graduates. The entire cohort (43 students) was offered the opportunity to participate in the study. The intervention was scheduled at a time that did not interfere with class and clinical schedules. Students were free to participate or not. There was no penalty for not participating or incentive to participate other than the experience itself. The museum covered the cost for parking and entrance to the museum. Because the data collection was anonymous and this was an optional and nongraded experience, there was little possibility of retribution. Twenty-three students elected to participate. Auscultation of normal heart, lung, and bowel sounds is taught in the first semester of nursing school. At the time of the "looking" or observational and "listening" or auscultative pretest, students had completed over 800 hours of direct clinical experience and were in their final 6 weeks of nursing school. Students were pretested on their observational skills using two images of patients with specific disease processes. Each picture was individually sealed in an envelope and labeled as *photograph one* (deep vein thrombosis [DVT]) and *two* (chronic obstructive pulmonary disease [COPD]). Students were allowed 5 minutes to observe the patient photograph and 5 minutes to record all observations in the *Socrative*® cloud-based student response system; at the end of 5 minutes of recording details, the students were given 3 minutes to type their interpretations of the clinical issue represented in the picture. All students progressed in unison from photograph one and two.

Auscultative ability was evaluated by correctly identifying the organ sound they were hearing (either lung, heart, bowel) and interpreting 25 specific sounds. Scores were calculated by adding the number of correctly identified organs (i.e., heart) and specific sounds (i.e., S3 gallop). For example, if a student correctly identified 8 out of 10 sounds correctly, then they would have a score of 8. The mean score is for the entire group and represents the mean number of correctly identified organs or specific sounds. Further details on the auscultative pre- and posttest are described below. The study was approved as expedited by the Human Subjects Research Review Committee of Mount Saint Mary's University.

The Looking Intervention

Students spent 3 hours with a gallery expert and nurse educator at the Los Angeles County Museum of Art. The professional art educators were trained in the technique of looking by the fifth author. Students were placed in groups of four where each student was assigned a painting to view alone. Each painting was narrative in nature, rich in detail, and had a degree of ambiguity. Under the direction of a gallery instructor, students were gathered together, and the student who was assigned the painting was asked to objectively describe what they observed in their painting. The gallery instructor challenged subjective statements because only objective observations were allowed in this phase. After a visual inventory was completed, the student then described their interpretation of what was happening in the painting. In this phase, students made inferences based upon their observations; however, their conclusions had to be grounded in visual evidence. After this phase, the gallery experts opened up the discussion to the other nursing students to consider any additional observations or inferences. Finally, the gallery expert reviewed the historical information about the art. The art museum experience was a single event lasting approximately 90 minutes per group of four students. Immediately after the activity, nursing students were given a variety of photographs of patients with disease processes and asked to replicate the skills used in the art exercise to distinguish aspects of a particular disease or condition under the direction of the first author.

The Listening Intervention

The listening aspect consisted of a 3-hour aural training on pitch, timbre, rhythm, and masking. The fourth author created music that replicated normal and abnormal heart, lung, and bowel sounds. Each music sample was presented with a visual diagram of its rhythm, frequency, speed, and volume. Students then listened to synthesized heart, lung, and bowel sounds followed by audio transmissions of actual normal and abnormal cardiac, pulmonary, and gastrointestinal sounds and identified them by their timbre, pitches, and patterns (i.e., timing, inspiratory crackles, expiratory wheeze). The clinical nursing instructor reviewed anatomical, physiological aspects, and physical assessment techniques with each auscultation. Masking activities consisted of a merging of synthesized heart lung and bowel sounds, where students were challenged to identify normal and abnormal sounds while listening to three different auscultative sounds (i.e., hyperactive bowel sounds, systolic murmur, and normal vesicular lung sounds played concurrently).

Students were posttested 14 days after completion of the educational interventions. The posttest replicated the pretest by using the same two pretest images of patients and 25 sounds (5 bowel sounds, 10 heart sounds, and 10 lung sounds). The bowel sounds were hypoactive (n = 1), normal (n = 2), and hyperactive (n = 2). The heart sounds were normal S1S2 (the first heart sound referred to as S1 and second heart sound as S2) (n = 2), split S2 (asynchronous closure of aortic [A2] and pulmonic [P2] valves) (n = 1), systolic murmur (n = 2), diastolic murmur (n = 2), S3 (termed a *gallop that is associated with early diastolic filling and may be pathological*) (n = 2), and S4 (another gallop associated with late diastolic sound that also may be pathological) (n = 1). The lung sounds were normal vesicular breath (n = 1), decreased breath (n = 1), wheezes (n = 1), crackles (n = 1), stridor (n = 1), tubular or bronchial breath sounds (n = 1), whispered pectoriloquy (n = 1), friction rub (n = 1), and crackles with expiratory wheezing (n = 2). Timing of the adventitious sound was also evaluated (i.e., could students accurately assess inspiratory crackles vs. expiratory wheezing).

The sounds were specifically developed for this study by MPL®, Professional Health Educators' simulated sounds, and taped sounds using a Littman ® electronic stethoscope recorded from actual patients. All sounds were played on a computer using Windows Media Player® and a sound card capable of producing high-quality sounds. The sounds were played for 2 minutes, and participants typed into a document the organ that made the sound (identified whether the sound was a heart, a lung, or a bowel sound), followed by their interpretation of that sound (i.e., pleural friction rub, diastolic murmur, hyperactive bowel sounds).

Data Collection and Analysis

Demographic data were collected on students, including educational background, age, music and art experience, and visual or hearing impairment. *Music experience* was defined as having greater than 6 years of lessons in music, and *art experience* was defined as an undergraduate or graduate degree in art history or fine arts or advanced training in the arts (drawing, painting, sculpture). Data were double entered by the first and sixth author into spreadsheets.

Data were available for 23 participants for the listening portion of the project. For the looking portion of the project, we were missing pre- and posttest data on one participant and posttest data for another participant. One participant did not provide demographic data.

The number of observations was measured by tallying the written word count for each picture. Observations were also categorized into the total number of observations, the number of objective physical assessment findings (PA), and the number of diagnoses by the first and sixth authors who independently analyzed the data and conferred to discuss any concern over whether an observation was plausible. Examples of objective comments included asymmetry of arms, right arm edema, tripod position, and pursed lip breathing. Fluidity was measured by number of alternative interpretations offered by the students. For example, for the photograph of arm DVT, possible assessments included DVT, fracture, iv infiltration, and sprain. An example of nonplausible observation was "liver disease" for the image of a patient with unilateral arm edema.

We conducted a univariate descriptive analysis where we examined data for missing values and outliers and evaluated the distribution and variance of continuous variables. Some outcome variables did not appear normally distributed; therefore, we relied on nonparametric tests.

To determine if the looking and listening interventions were effective, we assessed if participants' scores improved from pretest to posttest. For the listening intervention, we hypothesized that the median number of correctly identified organ and organ sounds would increase from pretest to posttest. We conducted Wilcoxon signed ranks tests to assess if the difference in the ranks of the scores was different from zero. We also tested to see if correct identification of individual sounds improved, using McNemar's test. For the looking intervention, we hypothesized that for each image, the total word count, the total number of observations, the number of objective PA, and the number of diagnoses would all increase. We used Wilcoxon signed ranks tests for these outcomes as well. In addition, in order to determine if participants significantly improved on making a correct diagnosis from observing the two images, we used a McNemar's test.

We also used the Kruskal–Wallis and Wilcoxon tests to examine if the demographic variables gender, undergraduate degree type (Bachelor of Arts [BA] vs. Bachelor of Science [BS]), age, art training, years of musical lessons, ability to read music, work experience prior to nursing school, and visual or hearing impairment were associated with the main outcomes of correct total organ identification and total organ sound (listening intervention), total number of observations, number of objective PA, and number of diagnoses (looking intervention) at pre- and posttest. None was significant with the exception of those with a BA that had significantly higher scores on Image 1 (DVT) total number of observations at pretest and Image 2 (COPD) number of diagnoses at posttest (P = .0092 and P = .02, respectively), and those who had art training scored significantly higher on Image 1 number of objective PA at pretest (P =.0045). We adjusted for art training for the looking data and years of musical lessons for the listening data in multivariate repeated measures regression. Analyses resulted in consistent findings. Given the consistent findings and limited associations, we report the bivariate analyses only. All data were analyzed using the statistical software Statistical Analysis System (SAS) version 9.3®.

Results

Demographics

Table 1 shows the demographic breakdown of students participating in this study. The majority of students were between the ages of 25 and 50 (77.3%), female (86.4%), with baccalaureate degrees in the arts (64%); 64% had music lessons, 32% could read music, and 36% had training or experience in the visual arts. Nine percent reported *visual impairment*, defined as using glasses or contact lenses, and no student disclosed documented hearing deficits.

Looking

Tables 2 and 3 present data regarding the looking aspect of the intervention. Outcomes included total number of observations, number of PA, word count, and whether a correct diagnosis was made. Two pictures were viewed. For Image 1, DVT, total word count did not change between pretest and posttest. Number of total observations significantly increased from 20 to 31, number of PA significantly increased from 7 to 16, and number of assessments significantly increased from 0.5 to 1. Of these diagnoses, only one participant was correct with the diagnosis at the pretest, and 14 were correct at the posttest (P = .0003).

For Image 2, which was an image of COPD, total word count increased significantly between pretest (132 words) and posttest (187 words) (P = .0097). Number of total observations significantly increased from 26 to 33, and number of PA significantly increased from 8 to 12. Number of diagnoses did not increase from pretest to posttest, with the median number of 1. However, 64% at pretest and 91% at posttest were correct with the diagnosis. Participants improved from pretest to posttest; the improvement approached significance (P = .059).

Table 1. Demographics of MSMU Participants (n = 22)

Characteristic	Frequency (%)
Age	
18–24	5 (22.7)
25–29	9 (40.9)
30–50	8 (36.4)
Female	19 (86.4)
Male	3 (13.6)
Type of undergraduate degree	
Bachelor of arts	14 (63.6)
Bachelor of science	8 (36.4)
Type of graduate degree	
Masters of art	1 (4.5)
Worked prior to school	20 (90.9)
Able to read music	7 (31.8)
Ever had music lessons *	14 (63.6)
Ever had art training	8 (36.4)
Visual impaired	2 (9.0)
Hearing impaired	0 (0.0)

* Mean years of musical lessons is 2 years (SD = 2.8).

Listening

Outcomes regarding listening aspects of this program included counts of correct organ (heart, lung, and bowel) identification and corresponding sound identification and a total number of correct organs and sounds identified (see Table 4). The percentage of correctly identified total organs was 87% for the pretest and 94% for the posttest, leading to an overall improvement of 7% (P = .0051). The greatest improvement in correctly identifying the organ was seen with the bowel, where the mean score at pretest was 68% and, at posttest, was 90% leading to a 32% improvement. Correct organ sound identification scores were lower than correct organ identification scores, ranging from 10% (heart) to 38% (bowel) at pretest and 35% (heart) to 58% (bowel) at posttest. The greatest improvement was seen in correctly identifying heart sounds, where participants improved by 263%, followed by lung sounds with 109% improvement and then bowel sounds, with 52% improvement. Table 5 details the results of individual sounds used in the pretest and posttest.

Participants were unable to identify most heart sounds correctly at the pretest, with the exception of the two normal sounds. The proportion of those who correctly identified heart sounds at posttest increased significantly for the S4, both diastolic murmurs, and both systolic murmurs; yet, the proportion correctly identifying sounds remained small. The biggest improvements were seen with S4 (50% improvement) and diastolic murmur (70% improvement).

At pretest, no participant correctly identified a normal lung sound; at posttest, however, 57% correctly identified the sound as normal (P < .0001). Almost half of participants (48%) correctly identified expiratory wheezing at pretest. Most other sounds were not correctly identified. Improvement was significant for crackles and expiratory wheezing sound, whispered pectoriloquy, and stridor (see Table 5).

Discussion and Implications

This study revealed that nursing students 6 weeks before graduation could correctly identify specific heart, lung, or bowel sounds only 10%, 20%, and 40% of the time, respectively. In addition, although 14 of 22 students could identify COPD at the pretest period, only one student could identify a DVT of an upper extremity. However, 3 hours in a museum with a gallery expert and nursing educator and 3 hours in a classroom with a music expert and nursing educator translated into improved perceptual abilities of these nursing students. Specifically heart sound interpretation improved by 263%, lung sounds improved by 109% improvement, and bowel

Table 2. Identification of Signs at Baseline and After Completion of Looking Education, *N* = 22 *

Variable	Pre			Post			Wilcoxon Signed Rank Test (*P*)
	Median	Mean	*SD*	Median	Mean	*SD*	
Image 1							
Total word count	121.50	142.73	52.31	153.00	148.52	58.60	.6023
Total observations	20.00	21.23	6.78	31.0	31.33	11.02	.0003
Objective PA findings	7.00	7.95	3.24	16.00	16.33	6.49	<.0001
Number of diagnoses	0.50	0.64	0.79	1.00	1.67	0.86	.0006
Image 2							
Total word count	132.00	143.45	55.57	187.00	173.90	52.52	.0097
Total observations	26.00	26.86	7.80	33.00	33.62	10.41	.0186
Objective PA findings	8.00	8.00	2.58	12.00	12.57	4.31	.0003
Number of diagnoses	1.00	1.41	1.05	1.00	1.29	0.72	.6479

* There were 23 participants in the program, pretest data are missing on two people, posttest data are missing on one person.

Table 3. Correct Diagnosis Based on Assessment of Signs

Variable	Pre		Post		McNemar's
	Correct	%	Correct	%	
Image 1 correct diagnosis of arm DVT	1	4.55	14	66.67	0.0003
Image 2 correct diagnosis of COPD	14	63.64	19	90.48	0.0588

n = 22 (missing one posttest).

sounds had a 52% improvement. The ability to provide objective assessment data improved from 7 to 16 PA (Image 1 [DVT], *P* = .0003) and from 8 to 12 for Image 2 (COPD; *P* = .0588) leading all clinical educators to consider whether traditional pedagogy is preparing our students for the complex world of clinical nursing where Registered Nurses (RNs) need to assess for and identify auscultative sounds and important physical examination findings. Our standard nursing training traditionally includes didactic lecture followed by laboratory experience with normal peer subjects or simulated sounds followed by clinical experience with patients. The limitations of these traditional methods include the variability of clinical preceptor's skills in helping students identify and name abnormalities, the time-intensive process of evaluating students' ability, and inconsistent exposure to important abnormal body sounds and clinical pathology in the clinical setting. A limitation of this study is that the posttest was conducted 2 weeks after the educational interventions. It would be interesting to see if students maintained their improved assessment and auscultative abilities long term. However, it is exciting to

Table 4. Correct Identification of Organs and Sounds at Baseline and After Completion of Listening Education, *N* = 23

	Number of Sounds	Baseline			Posteducation			% Improvement	Wilcoxon Signed Rank
		Mean Score	(*SD*)	%	Mean Score	(*SD*)	%		
Correctly identified organ (heart, lung, or bowel combined)	25	21.78	2.43	87.12	23.39	1.75	93.56	7.39	0.0051
Correctly identified specific organ sound	25	4.91	2.37	19.64	10.65	3.69	42.60	116.90	<.0001
Correctly identified organ as heart	10	9.35	0.89	93.50	9.35	0.94	93.50	0.00	0.8872
Correctly identified specific heart sound	10	0.96	0.88	9.60	3.48	1.73	34.80	262.50	<.0001
Correctly identified organ as lung	10	9.04	1.15	90.40	9.56	0.73	95.60	5.75	.0418
Correctly identified specific lung sound	10	2.04	1.43	20.40	4.26	1.57	42.60	108.82	.0003
Correctly identified organ as bowel	5	3.39	1.41	67.80	4.48	0.85	89.60	32.15	.0038
Correctly identified specific bowel sound	5	1.91	1.56	38.20	2.91	1.54	58.20	52.36	0.0117

Table 5. Identification of Individual Sounds Pretest and Posttest (n = 23)

	Correctly Identified Sound							
	Pre		Post			% Improvement *		
Sound	*N*	%	*N*	%	Exact	*n*/*n* ‡	%	McNemar's
Bowel								
Normal	4	17.39	10	43.48	0.108	7/19	36.84	0.034
Hyperactive 1	10	43.48	11	47.83	1.000	4/13	30.77	0.706
Hyperactive 2	11	47.83	11	47.83	1.000	4/12	33.33	1.000
Hypoactive 1	12	52.17	16	69.57	0.365	7/11	63.64	0.206
Hypoactive 2	9	39.13	19	82.61	0.006	12/14	85.71	0.008
Heart								
Normal 1	12	52.17	12	52.17	1.000	7/11	63.64	1.000
Normal 2	7	30.43	11	47.83	0.365	6/16	37.50	0.157
S3 Gallop 1	2	8.70	4	17.39	0.665	3/21	14.29	0.317
S3 Gallop 2	1	4.35	3	13.04	0.608	3/22	13.64	0.317
S4	1	4.35	12	52.17	0.001	11/22	50.00	0.001
Split S2	0	0.00	3	13.04	0.233	3/23	13.04	†
Diastolic murmur	0	0.00	6	26.09	0.022	6/23	26.09	†
Diastolic murmur	0	0.00	16	69.57	<0.0001	16/23	69.57	†
Systolic murmur 1	0	0.00	6	26.09	0.022	6/23	26.09	†
Systolic murmur 2	0	0.00	7	30.43	0.009	7/23	30.43	†
Lungs								
Normal breath sound	0	0.00	13	56.52	0.000	13/23	56.52	†
Crackles	8	34.78	11	47.83	0.550	7/15	46.67	0.366
Crackles + wheezing 1	1	4.35	8	34.78	0.022	7/22	31.82	0.008
Crackles + wheezing 2	5	21.74	10	43.48	0.208	8/18	44.44	0.132
Inspiratory crackles	7	30.43	12	52.17	0.231	8/16	50.00	0.132
Expiratory Wheeze	11	47.83	13	56.52	0.768	6/12	50.00	0.527
Whispered pectoriloquy	0	0.00	11	47.83	0.000	11/23	47.83	†
Tubular breath sound	0	0.00	1	4.35	1.000	1/23	4.35	†
Stridor	2	8.70	13	56.52	0.001	11/21	52.38	0.001
Friction rub	1	4.35	6	26.09	0.096	6/22	27.27	0.059

* Of those who incorrectly identified the sound at baseline but correctly identified it postintervention.
† None correctly identified sound at baseline; McNemar's test statistic not calculated.
‡ Numerator is number of participants who incorrectly identified the sound at baseline but correctly identified the sound upon posttest. Denominator is total number of participants who incorrectly identified the sound at baseline.

see such a vast improvement in a relatively short period of time. In addition, these students will soon enter the workforce and have the opportunity to practice and further develop these skills in the clinical setting; the caveat, however, is that they had already completed over 800 hours of clinical.

This study has demonstrated improved student observational skills with the use of arts for visual training and music for aural training for accelerated BSN nursing students. This interdisciplinary program is a unique collaboration between the arts and sciences and not only brings together the science, technology, engineering, and math disciplines but also gives rise to the STEAM (addition of the arts) effect in today's teaching and curricula. Our future research efforts will refine both the visual and aural aspects of the training materials for those artificial body sounds that were less successful, assess retention of the auscultative and observational abilities over time, and detailing gallery teacher training, rationale behind selection of paintings, and creation of a tool kit for nursing educators.

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