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Teaching and Technique in Dance Medicine and Science

A Descriptive Study with Implications for Dance Educators

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Abstract

The scientific basis of human movement has been studied by dance students, teachers, and researchers in the United States since Margaret H'Doubler established the first dance major at the University of Wisconsin in 1926. Since then, students, faculty, practitioners, and researchers have applied a scientific line of inquiry toward dance movement and training. In the 1980s, medical practitioners and researchers involved with dance populations joined this scientific approach movement. This article is a descriptive study that catalogs and details peer-reviewed articles under the topic headings of teaching and technique. With 229 listed publications, teaching and technique are popular topics. This study delimits analysis of these publications to those in peer-reviewed journals, narrowing the field to 59 articles. In this study, research was organized three ways: 1. by the type of research (descriptive studies, analytical studies, experimental studies), 2. by the identification of interests (area of interest and agent of change, item of interest and type of analysis, dependent and independent variables), and 3. into four main themes (participant health, teaching effectiveness, quality of learning and performance, and the field of dance education). Findings are organized into tables for easy navigation and reference. It is hoped that accessibility to and easy navigation through this research will provide teachers with information and support toward informed choices and healthy classrooms. The ultimate aim is to provide a starting place from which dance students, educators, and researchers can develop their own dance medicine and science inquiries into teaching and technique.

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Have you ever wondered what type of accompaniment would work best for your beginner dance students? Have you considered whether you should build toward a movement phrase or present the material as a whole and then break down elements? Perhaps you have questioned the benefits of mirrors, or pondered ways to integrate somatics into your technique classes. Do you wonder if research exists on these and other topics that directly impact your teaching? Publication of dance medicine and science material concerning teaching and technique is abundant. However, there is room for growth in the dissemination and application of these research findings. The target audience for this writing is dance students, teachers, and researchers with a curiosity for what dance medicine and science research has discovered concerning learning, teaching, and the technique class because it is students and teachers who make decisions concerning what happens in the dance classroom. The following report offers scientific findings to inform these decisions.

The world of teaching dance technique is fast paced and ever-changing. Definitions of dance,

teaching, and technique are shifting as dance continues to evolve. Teachers and students are constantly searching for ways to contribute to the evolution by finding new information and methods to enhance learning, performance, and forms. The dance medicine and science community shares this passion for development in dance with an emphasis on using scientific research to enhance learning, performance, artistry, and the health and well-being of dancers.

The purpose of this report is to catalog and describe published dance medicine and science research on teaching and technique. Ruth and John Solomon's *Dance Medicine and Science Bibliography*[57] was selected as the exclusive resource for locating publications. The initial research inquiry discovered 229 sources on the topics of teaching and technique. This substantial group of material covered many types of publications, a variety of subjects, and considered multiple perspectives. Finding a way to make the navigation of the material user friendly for students, teachers, and researchers is a primary aim of this study. The hope is if individuals can find their interests in the research on teaching and technique, they will then read the articles and start applying findings toward the technique class. The main question addressed in this research is "What topics of teaching and technique are being researched in Dance Medicine and Science?"

Delimitations

The breadth of the literature published on the topics of teaching and technique is impressive. The varying perspectives of the teacher as educator, historian, somaticist, artist, and scientist are well covered in published literature. Each offers beneficial elements to the world of teaching, and all come from a shared understanding of the dance classroom as a place of possibility. Because this article focuses on dance medicine and science publications, Solomon and Solomon's text is exclusively selected. It is an established resource used by the dance medicine and science fields and is a database sorted by author and subject, with alphabetical listings including topics ranging from "acupuncture" to "warm-up."[57] Table 1 shows the distribution of research material on teaching and technique from Solomon and Solomon's text.

To further focus this work, only peer-reviewed articles under the topics of "teaching" and "technique" in Solomon and Solomon[57] were selected because these articles offer what researchers generally consider a high quality of research in publication. All articles covered in this study are listed in alphabetical order in the reference list.[1-60]

It is understood that to classify the contents of a publication under a single subject heading may be an oversimplification. Also, many fascinating pieces of information, which are not included in this research inquiry, were uncovered while reading studies. The hope is that readers will use findings presented in this document to locate articles and develop their own interests and opinions from reading.

This work is further delimited by inclusion of only concert style forms of dance (ballet, modern, jazz, and so forth). Vernacular forms (such as swing, hip hop, Balinese dance) and "aerobic dance" are not included in this review. Also, due to linguistic limitations, only articles written in English are included.

Method of Content Analysis Applied to the Literature

To effectively describe the literature covered in this study, the material is first organized by kind and content. Peer-reviewed articles listed in Solomon and Solomon[57] are sorted by content using three different types of analysis. First, the material is sorted by determining the type of research used. This first sort is referred to as the Classification of Research Type. Next, the material is sorted by identifying the topics covered in the article. This second sort is referred to as Identification of Interests. The final sort searches for broader themes. Four themes are

Table 1 Teaching and Technique Publications in Dance Medicine and Science Literature (1966-2005)

Publications	1964 to 1969	1970 to 1975	1976 to 1980	1981 to 1985	1986 to 1990	1991 to 1995	1996 to 2000	2001 to 2005	Totals
Books	1	3	2	2	19	9	15	2	53
Conference Proceedings	0	3	6	1	2	22	0	0	34
Reports	0	0	0	0	2	1	1	0	4
Periodicals	12 (0*)	0 (0*)	16 (2*)	26 (9*)	25 (6*)	32 (21*)	15 (13*)	12 (8*)	138 (59*)
Totals	13	6	24	29	47	64	31	14	229

*Number of peer-reviewed articles

identified in the literature; therefore, this final sort is referred to as Four Main Themes.

Classification of Research Types

Classification of the research material falls under three categories: Analytical, Descriptive, and Experimental. Analytical Studies look at areas of interest through a variety of investigative lenses that include examination of observational data and theory building through expert opinions. Most of the studies cover components of dance training. An example is a study by Laws[37] that uses biomechanics (physics of motion) to explain the potential for injury in dance. Table 2 covers Analytical Studies published in peer-reviewed dance medicine and science journals on the topics of teaching and technique.

The classification of Descriptive Studies includes case studies, correlational studies, surveys, and descriptive writing in general. A descriptive study uses observation to illustrate an idea of interest. For example, Lord[40] developed and employed a system of description for characterizing dance teacher behaviors. Table 3 lists all of the Descriptive Studies concerning teaching and technique published in peer-reviewed dance medicine and science periodicals.

The final classification is for Experimental Studies in the areas of teaching and technique in peer-reviewed dance medicine and science literature. For these studies the independent variable was manipulated, and the impact on the dependent variable was measured. For example, Pollatou and colleagues[52] applied different types of music (rhythm or melody based) to a movement phrase and observed how the music impacted the students' motor performance. Both quantitative and qualitative works are included in this domain. Experimental Studies are identified in Table 4, by listing the author, date, citation number, the independent variable, and the dependent variable.

Identification of Interests

The Identification of Interests identifies specific topics researchers were investigating in their studies. In most studies this was clearly stated in the article's purpose statement or was identified in research hypotheses. Since this study involves different types of research, it is important to clarify the various vocabulary used to identify interests.

Analytical Studies refer to the Item of Interest (the specific concept researchers wished to investigate) and Method of Analysis (system for breaking down the concept's components) utilized in the study. Descriptive Studies refer to their Area of Interest (general topical area researchers tried to describe) and the Focus of Description (specific components of the topic described in detail). Experimental Studies refer to the hypothetical cause-and-effect relationship investigated. These are the Independent Variable (a variable researchers manipulate, the "cause") and the Dependent Variable (a variable which is being measured, the "effect").

Four Main Themes

Finally, analysis of broad areas of concern across all types of work included here yielded four main themes dance medicine and science researchers are investigating: Quality of Learning and Performance, Participant Health, Teaching Effectiveness, and The Field of Dance Education. These areas were identified to accommodate readers' general interests and enable readers to reference their interests throughout this report.

Quality of Learning and Performance addresses strategies employed to improve the students' experiences in learning or dancing. This area includes broad concepts like technique, as well as articles with a specific focus (e.g., a particular step). An example is an analytical study that discusses how developing critical thinking skills can improve the quality of student performance and empowerment.[43]

Participant Health includes articles that examine general and specific issues that may impact the well being of students, dancers, or teachers. Physical as well as psychological issues are addressed in this research. An example of this is an analytical study that discusses movement patterns to understand the effect of improper technique on ankle tendonitis.[3]

Teaching Effectiveness covers proposed ways that educators might improve their dance teaching abilities. The ideas covered in this area of research address what instructors know or believe about teaching dance, organization of class material, class content, or how instructional tasks are communicated to students. An example of this is an experimental study that examines how behavioral coaching impacts teaching effectiveness.[14]

The content covered under The Field of Dance Education considers educators' perspectives on broad concerns involving the quality of teaching in dance education. These studies appeared in analytical and descriptive research only, for example, the importance of understanding student perspectives when considering dance education reform.[58]

Presentation of Findings

The tables are formatted to display the organizational sorting described above. There are three tables identified by Classification of Research Type: Analytical Studies (Table 2), Descriptive Studies (Table 3), and Experimental Studies (Table 4). Each category of the Four Main Themes lists articles in chronological order. This choice was made to reveal

Table 2 Analytical Studies on Teaching and Technique

	Item of Interest	Method of Analysis
Quality of Learning and Performance		
Laws K, 1985[36]	Physics in Dance	Biomechanical Techniques
Berardi G, 1991[2]	Movement in Dance Technique	Biomechanical Analysis
Meglin J, Woollacott M,1991-92[45]	Cognitive Grasp of Pirouette-Arabesque	Neuromuscular Analysis
Minton S, 1991-92[46]	Body Awareness and Movement Patterns (Mind/Body Connection)	Imagery
Cherveny S, 1995[5]	Dance Training (kinesthetic sense, muscle isolation, lumbo-pelvic stability)	Floor Barre
Molnar M, 1995[48]	Dynamic Assessment of Participants	Gait Analysis
Kane N, 1996[31]	Student Experience of Dance in Composition Class	Situated Cognition and Cognitive Apprenticeship
Green J, 2002[23]	Quality of Dance Education	Somatics Integration
Matt P, 2003[43]	Quality of Student Performance and Empowerment	Critical Thinking Skills
Participant Health		
Laws K, 1986[37]	Potential for Dance Injury	Biomechanical Analysis
Gelabert R, 1986[19]	Dancers' Spinal Syndromes	Orthopedic Analysis
Braver RT, 1988[3]	Effect of Improper Technique on Tendonitis Rond de Ankle	Movement Observation for Technical Errors
Gantz J, 1989-90[18]	Occurrence of Injury	Technical Accuracy
Hamilton L, Hamilton W, 1991[25]	Dancer's Health	Ballet
Howse J, 1994[30]	Occurrence of injury	Knowledge of Anatomy and Developmental Stages
Trepman E, et al, 1994[59]	Standing Posture in Demi-Plie in Ballet and Modern Dancers	Electromyographic Analysis
Clouser J, 1995[8]	University Pointe Students' Well-Being	Somatics and Student Centered Techniques
Hamilton L, 1997[26]	Emotional Health of Performers	Psychological Analysis
Mainwaring L, et al, 2001[42]	Injury	Emotional Health of Dancers
Teaching Effectiveness		
Davenport D, 1993[10]	Understanding of Teacher Vocalizations	Catalog of Teacher Vocalization Characteristics
Krasnow D, Chatfield S, 1996[34]	Enhancement of Technique Class	Dance Science Integration
Enghauser R, 2003[13]	Re-examining Traditional Teaching Practices	Motor Learning Perspectives
Field of Dance Education		
Downey P, 1996[12]	Occurrence of Dance	PE Majors Teaching Dance
Clippinger K, 1997[7]	Quality of Dance Education	Teacher Certification
Lee S, 1997[39]	Quality of Dance Education	Preparation of Teachers

any trends that reference time of publication. All articles cited in the tables can be located in the reference list at the end of this article.

Discussion

In this section, articles are counted to identify the popularity of types of research. The research is analyzed across time to identify the distribution of various types of research. Content of the studies is examined to identify trends occurring in the field. Additional comments in articles (such as requests for further research) are noted. It is important to remember that no critical review concerning quality of research has been performed on any of the mate-

Table 3 Descriptive Studies on Teaching and Technique

	Area of Interest	Focus of Description
Quality of Learning and Performance		
Hinson M, et al., 1977-78[29]	Grand Jete Entournant Entrelace	Motion Photography
Laws K, 1978-79[35]	Turns in Dance	Biomechanical Techniques
Schick J, et al, 1983[56]	Balancing Performance	Modern Dance Experience
Gray M, Skrinar M, 1984[22]	Base of Support used in Warm-Up and Dancing	Type of Dance (Ballet or Modern)
Hellerman A, Skrinar M, 1984[28]	Technical Skill Rank	Age, Gender, Number of Years of Dance Training
McNitt-Gray J, et al, 1992[44]	Kinematic and impulse characteristics in jump landings	Dance Training
Penrod J, 1994[50]	Quality of Student Work	Student Empowerment in Choreography Class
Barr S, 1996[1]	Student Experience of Dancing	Bartenieff Fundamentals
Laws K, 1998[38]	Momentum Transfer	Biomechanical Techniques
Participant Health		
Kerr G, et al, 1992[33]	Occurrence of Injury	Correlation between Dance Participation, Postural Alignment, and Injury
Robson B, Gitev M, 1993[54]	Health of Students	Participation in the Arts (including Dance)
Guggenheim C,1994[24]	Occurrence of Injury	When / How Pointe Begins
Dahlstrom M, 1997[9]	Comparison of Students, Teachers, and Students Teaching	Physical Effort (HR, VO2max)
Teaching Effectiveness		
Lord M,1981-82[40]	Catalog of Teacher Behaviors	Systematic Observation
Gray J, 1983[20]	Recording Teaching Behaviors	Systematic Computer Observation
Gray J, 1984[21]	Catalog of Teaching Behaviors	Systematic Observation
Karp G, Walker D, 1990[32]	Instructional Techniques	Hemispheric Preferences
Fortin S, 1993[15]	Teaching Modern Dance	Dance Science and Somatics
Lord M, et al,1995[41]	Teaching Practice	Awareness of Teaching Strategies
Downey P, et al, 1996[11]	Response Acquisition and Performance Reproduction	Correlation between levels in dance ability, style of dance, and modeling effects
Minton S, 1996[47]	Patterns of Imagery Use in Teaching	Individual Teacher, Level, or Type of Class
Carr S, Wyon M, 2003[4]	Ego, Anxiety, Perfectionism, and Task Orientation	Survey of Student Perceptions concerning learning environment
Field of Dance Education		
Stinson S, 1993[58]	Education Reform	Understanding Student Perspectives
Fortin S, Siedentop D, 1995[16]	Dance Education	Knowledge Base and Methods of Delivery in Pedagogical Praxis

rial included. This report simply states findings as listed in the studies.

Analytical Research

Analytical research reveals the interdisciplinary nature of dance medicine and science. Experts in various scientific fields (e.g., biomechanics, motor control, psychology, orthopedics, and other areas of scientific interest) are using their knowledge to offer an outside perspective to aid in the understanding of dance education. For example, Enhauser reexamines traditional teaching practices and offers readers motor learning perspectives and contemporary trends in teaching for consid-

eration.[13] Analytical research is well-distributed, with 24 publications out of the 59 total articles from 1986 to 2003.

Descriptive Research

Descriptive research is represented by 25 publications spanning chronologically from 1977 to 2003. An analysis of results for descriptive studies suggests what appears to be a shift in the focus of the works over time. From 1977 through 1990, nine studies offer integral information concerning injury (e.g., correlation between dance participation, postural alignment, and injury[33]) as well as analysis of *what* was happening in dance classrooms (e.g., catalog of teacher behaviors[40]). After 1990, the focus shifts toward the experience of learning and performing, and *how* things are happening in dance classrooms (e.g., student perceptions of the learning environment[4]). This is the most popular type of research in this report. Reasons for the popularity of descriptive research may include:

1. Authors' experience with teaching may have nurtured their abilities in descriptive language.
2. This type of research may better accommodate the methodologies and interests of those in the field of dance education.

Experimental Research

Experimental research is the smallest group of articles, with 10 spanning chronologically from 1983 to 2003. Reasons why experimental research is rare may include:

1. The financial and time commitment necessitated by experimental research designs.
2. The notion that the dance classroom is an environment designed for dancing and is not conducive to reductionist, laboratory research.
3. The complexity involved in how one might accurately measure dance and learning.

In the Experimental research findings, 3 periods of publication become apparent:

1. 1983-1986 covers "what" is happening in dance classrooms (e.g., bilateral transfer ,[51] the effects of behavioral coaching,[14] and augmented feedback on motor performance[6]).
2. 1992-1999 articles address ways to assist in performance enhancement (e.g., Pilates train-

Table 4 Experimental Studies on Teaching and Technique

	Dependent Variable	Independent Variable
Quality of Learning and Performance		
Puretz S,1983[51]	Bilateral Transfer	Practice
Parrott AA, 1993[49]	Technical and Aesthetic Performance	Pilates and Aerobic Training
Hanrahan C, 1994[27]	Effective Performance: Battement, Developpe Arabesque:	Imagery: (Wind, Beams of Light, Tree)
Welsh T, Fitt S, 1994[60]	Ease and Enjoyment of Learning in Students	Forward and Backward Chaining
Sawada M et al, 2002[55]	Comparison of Performance, Recognition of Modeling Skills in Children	Age of children, Type of Verbal Instruction (Metaphoric, Specific Movement Relevant
Pollatou E, et al, 2003[52]	Motor Performance	Accompaniment Type (Rhythm or Music)
Radell S, et al, 2003[53]	Rhythmic accuracy, ease and flow of movement, mastery of steps, and body alignment in adagio and allegro	Practice with Mirrors
Participant Health		
Clarkson P, et al, 1986[6]	Foot Pronation	Augmented Feedback
Gamboian N, et al, 1999[17]	Pelvic Tilt and Lumbar Lordosis Alignment During Quiet Stance and Dynamic Dance Movement	Dance Technique Training and Somatic Training (Focused on Sensory Awareness)
Teaching Effectiveness		
Fitterling J, Ayllon T, 1983[14]	Teaching Effectiveness	Behavioral Coaching
Field of Dance Education		
None	None	None

ing,[49] imagery training[27]).

3. Three articles found from 2002-2003 discuss external factors in the classroom environment (e.g., impact of type of verbal instruction,[55] effect of type of accompaniment, [52] and effect of mirrors on performance[53]).

Findings from experimental studies suggest the following cause-and-effect relationships:

1. Practicing a movement phrase and analyzing movement detail on one side will transfer to the performance of the movement phrase on the other side.
2. Pilates training is a means for improving alignment, intention of movement, and expressivity of the body. Aerobic conditioning is a means for improving expressivity of the body.
3. Specific imagery can enhance dance movement (battement and arabesque).
4. Metaphoric verbal instruction aids the recognition and performance of sequential dance skills in young children.
5. Beginners show improved motor performance when dancing to rhythmic accompaniment (from a tambourine).
6. Adagio performance improves without the presence of mirrors and does not improve when mirrors are present.
7. Augmented concurrent feedback (in the form of visual and auditory feedback) reduced the occurrence of foot pronation in both novice and skilled dancers.
8. Somatic training may effectively stimulate improved alignment in some individuals.

Seven out of the ten experimental studies request further research be performed concerning their area of interest; however, no follow-up studies or studies on the same topics were found, suggesting a disconnect in research consistency. Also, a unique trait for experimental research is that all of the studies are affiliated with academic institutions (colleges or universities).

Recognition of the value each publication offers the dance medicine and science community is important. Years of hard work went into the research design, data collection, analysis, and writing of each of these articles. A concern in performing this study is that the information and complexity contained in the published works might be minimized by the generic taxonomy used and that readers will not take the next step to find the articles and enjoy and apply insights offered. Each of these articles offers valuable ideas for students, teachers, and researchers to ponder. The hope is materials presented in this study will encourage readers to investigate the full articles and apply contents where appropriate toward their teaching, learning, and research.

Beyond This Report: Future Applications and Future Research

This report is designed to simply report information concerning the body of literature on teaching and technique in dance medicine and science publications. However, the authors hope that students, teachers, and researchers will take the next step and read articles included in this report and possibly become inspired to design research studies of their own.

The process of reading these articles may bolster the confidence level one brings to her teaching. Possession of additional information influences choices in the material, structure, and environment one selects for technique classes. Pedagogic decisions are no longer limited to firsthand perceptions or traditions handed down from teacher to student, but can also consider what researchers have found works for others. Readers can make informed decisions supported by this body of research.

As readers prepare to dive into the material and possibly develop their own research inquiries, there are a few concepts behind research that should be regarded. Scientific exploration is a way of searching for information. Many times it starts with a moment when someone is troubled or perplexed by an idea; this develops into the formulation of a problem or question that demands attention. Deductive scientific questions revolve around theories. A theory is a large idea, too grand to be tested. Researchers instead scale down the theoretical idea to a specific statement or hypothesis that they seek evidence to support or disprove. If evidence supporting a hypothesis is obtained, it can lend support to the larger theory. If the hypothesis is not supported by research findings, it can disprove the larger theory.

It is important to understand the complexity that lies behind research design. Research design plays an integral role in the quality of the research produced. Effective researchers acknowledge and control for variables that may impact what they are testing and thereby compete with the hypothesis to explain the results. Also, different types of research value different perspectives concerning the objectivity of data. In some studies, qualitative, firsthand accounts are often the basis of the research. In other research, efforts are put forth to reduce subjective data and rely instead on quantitative or objective analysis and statistical findings. Both of these approaches can be validated.

Research studies are typically conducted with specific groups and in specific contexts. Generalizability of results is limited to comparable groups,

situations, and contexts. It is also important to note that a single study in any one given area is not definitive. It is when results are able to be replicated that a scientist can be more confident that her findings were not a fluke. It is also fundamental that when conducting or simply reading research, one must maintain not only a critical perspective but also a creative perspective, searching for opportunity, information, and inspiration where it may not be obvious or expected. Some of the greatest discoveries in history have occurred by accident and resulted from an open attitude, observation, and analysis.

Conclusion

This report deals with only a small amount of the literature published on teaching and technique. Further investigation beyond the dance medicine and science literature would offer a more diverse view of the teaching literature. Dance medicine and science researchers are encouraged to embrace additional perspectives on teaching and technique and work together with educators, historians, somaticists, artists, and other scientists to continue investigating the dance technique classroom as a fertile laboratory. A critical review of the articles listed here could offer areas where additional research on teaching and technique should be conducted. Finally, it seems this field of research is still in its infancy, not so much in terms of the span of time involved, but in terms of the number of studies published and the cross validation and follow-up that has been accomplished. More research on teaching and technique, and specifically research that reexamines topics previously explored, would add support to this body of research literature.

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