Dance Science and the Dance Technique Class

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Abstract

This article examines methods of improving the dance technique class by applying principles from the dance sciences. A brief history of the development of dance science as a field separate from sport science is included. The text focuses on the areas of exercise physiology, dance psychology, and motor control and motor learning. The paper explores practical applications for the dance educator. The main purpose of these suggestions is to enhance the dance technique class without essentially altering the primary structure and artistic goals of the class.

For centuries, the practice of teaching dance technique and dance performance has focused on the mastery of the art form. Dance class existed primarily to broaden one's movement vocabulary and skills, to develop one's musicality and phrasing, and to enhance one's unique creativity and expressiveness through a particular voice or style. Although the traditional methods of teaching dance embody fine tools for the training of the dance artist, too many dancers are plagued with injury and frustrated by what seem insurmountable physical obstacles. For the current generation of young dancers, a new field, dance science, has emerged to provide some insights into these problems.

A History of Dance Science

Dunn (1990) states that a decade earlier, the term 'dance science' did not yet exist. She explains that this new field is an outgrowth of the sports science and sports medicine boom of the last two decades, and draws on research from fields such as kinesiology, biomechanics, exercise physiology, nutrition, and psychology. Although texts and journals in the sport sciences have been available for decades, the literature in the dance science field is comparatively recent. For example, Kinesiology: The Scientific Basis of Human Motion, a text for athletic studies, was first published in 1950. Authors Luttgens and Wells (1971) claimed that kinesiology was an essential component in the education of students in the fields of physical education and physical medicine. However, the first dance kinesiology text, Dance Kinesiology, was not published by Fitt until 1988. Fitt (1988) credits early pioneers such as Margaret H'Doubler, Mabel Ellsworth Todd, Raoul Gelabert, Lulu Sweigard, and Valerie Hunt in the application of movement sciences to the field of dance. Although some of their writings date back to early in this century, dance has been much slower than athletics in adding dance science studies to its educational scope.

Journals and associations in the dance sciences are relatively recent, and have emerged in the last decade to accommodate the increase in research that is currently

occurring in the field. The journal Kinesiology and Medicine for Dance has been in publication since 1989, although its predecessor, the newsletter Kinesiology for Dance, was in print in 1977. The Journal of Physical Education and Recreation was in existence in 1937; however, it did not add "Dance" to its title until 1981. And the newest journal, Impulse: The International Journal of Dance Science, Medicine, and Education began publication in 1993.

Currently, exchanges between dancers/dance educators and the medical personnel who care for dancers are less common in dance than in the athletic community. One organization which encourages such exchanges, the International Association for Dance Medicine and Science, formed in 1990, and held its first conference in the United States in 1991 (Dunn, 1990). The text Science of Dance Training, edited by Clarkson and Skrinar (1988), contains chapters by dance educators, dance researchers, and medical professionals. Similarly, Solomon, Minton, and Solomon (1990) published the book Preventing Dance Injuries: An Interdisciplinary Perspective, which brought together experts from the fields of medicine, exercise physiology, kinesiology, psychology, physical education, dance education, and the body therapies.

Assimilating Dance Science Information

As the flood of dance science information has become available, those who teach dance have begun the debate about whether or not to merge this knowledge into the practical setting, and if so, how this might most effectively be accomplished. Some of the concepts that have begun to influence the content and organization of technique classes are: appropriate warm-up procedures, information and methodology from the body therapies, basic conditioning principles, development of suitable levels of flexibility and strength, and corrective work for alignment problems (Plastino, 1990). Some teachers insist that a well-designed technique class must address each of these issues. Others argue that it is not possible to incorporate all that is now known about the body and its conditioning needs into the dance technique class.

There are certain deterrents to absorbing all of the dance science material directly into technique classes. First, to cover the information thoroughly, class could easily become more discussion than movement, and dance class needs to be fundamentally a motional experience. Simply giving students hour after hour of conditioning exercises without explaining the underlying principles would be inadequate. In order to understand which conditioning, strength, and flexibility exercises are most appropriate to one's personal physique, each individual student must have the background information to make informed choices. Second, dance is, first and foremost, an art form, and dance classes must maintain the sense that developing one's artistry, and the tools for expression, are the primary goals. While good biomechanics and kinesiology can underlie and support the content of dance class, they must not become the sole content. Third, as Watkins and Clarkson (1990) claim, there is quite simply not enough time. If the average class is one-and-one-half to two hours long, there is no way to stretch and strengthen every muscle group used by the dancer, and still have time to dance.

Outside Conditioning and Body Therapy Practices

In response to these points, many institutions are providing training sessions in addition to technique classes, either in group or individual settings, that address the conditioning and alignment issues. Some of these practices address exercise physiology concerns, and include programs such as weight training, flexibility training, aerobics activities, and specialized conditioning systems such as Pilates (Clarkson, 1988; Clippinger-Robertson, 1988). Other systems focus on motor control issues such as alignment and neuromuscular re-patterning, and include body therapies such as Bartenieff Fundamentals, Alexander Technique, Feldenkrais' Awareness Through Movement, and Sweigard's Ideokinesis (Myers, 1988).

Solomon (1990) claims that it can be beneficial to design individualized flexibility and strength training programs for students outside of dance class. These programs are highly useful in aiding the rehabilitation and prevention of injuries due to muscular imbalances, alignment problems, and other predisposing factors. Ultimately, however, Solomon maintains that the technique class itself must serve as the retraining ground, where new patterns can be enacted in a dynamic and demanding context. Thus, the improvements made in these training programs must be transferred into dance practice, and the technique class is the most appropriate setting for this process.

As more dancers embark on programs outside the technique class, however, the problems of transferring new patterns into daily dance classes and rehearsals are beginning to surface. Why does the student who achieves notable flexibility changes in yoga class still seem so tense and immobile in dance class? Why does a student come from body therapy work looking beautifully aligned, but a day later revert to old patterns in the dance studio? And why does the student who does strenuous abdominal exercises, and daily stretches for hip flexors and lumbar extensors still show no change in lordotic habits while dancing? The field of motor control and motor learning can perhaps provide insight into why some students have so little success in transferring information learned in one context to another.

The issue of transfer of training has been a topic of interest for physical therapists and motor development experts for some time. A study by Winstein (1989) focused on the principles of retraining used in physical therapy, and the assumptions about how actions such as locomotion and balance are learned, or relearned, and controlled. She questions two assumptions that are inherent in most physical therapy programs. The first, called part-to-whole task transfer, states that the practice of a component part of a particular action will improve the subsequent performance of that action. For example, practicing knee flexion and hip extension will improve the swing phase of walking. The second assumption is called transfer of training and it suggests that "...practice of a motor skill from the 'lower' end of our imaginary skill continuum will enhance performance of a motor skill from the 'higher' end of the continuum" (Winstein, 1989, p. 95). For example, doing weight-shifting exercises will improve locomotion skills.

Winstein conducted a study to determine quantitatively the effectiveness of various balance retraining programs on the balance and the locomotor skills of brain-injured adults. Pretest and posttest sessions included both stance and locomotor measurements. The results showed that certain balance retraining programs did have a significant positive effect on stability and balance. However, locomotor performance was not significantly improved for any of the subjects. Assuming the training and measurement systems were well designed and well administered, the results do not provide support for the theory that improved standing balance transfers to locomotor skills.

Similarly, in using conditioning and body therapy systems, dance educators make the assumptions, perhaps erroneously, that part-to-whole task transfer and transfer of training apply. For example, it is a common belief that enhanced strength or flexibility in a conditioning program will transfer to improved skills, such as jumping or leg extensions. It is also often assumed that re-alignment work done in body therapy sessions will have significant impact on the dancer's alignment habits when he or she returns to class or rehearsal. Every dance educator knows the dancer who systematically rehabilitates an injury, and is subsequently re-injured with the return to dancing.

How then can the dance sciences enhance the dance technique class? If it is not possible to assimilate all of the various dance sciences directly into the class, and if outside conditioning and body therapy practices do not necessarily transfer to studio dancing, what is the best approach to using this newly acquired knowledge? There are several areas of dance science studies that can be applied to the dance technique class without essentially altering the primary structure and artistic goals of the class. This paper will focus on three main areas of dance science and their direct applications to the technique class: exercise physiology, dance psychology, and motor control and motor learning.

Exercise Physiology

The field of exercise physiology includes a wide range of topics that can influence dance training, such as strength and flexibility enhancement, and anaerobic and aerobic conditioning. Even if dance educators decide not to alter their current class model by adding sections of conditioning, these topics can certainly inform how class is organized, both daily and over weeks or months. For example, sound technique classes can take into account a better understanding of appropriate warm-up procedures as well as applications of the overload principle. Further, the pacing and arrangement of material can be crucial in meeting the physiological needs of the dancer in training.

First, dance educators have become increasingly sensitive to the needs of the body in terms of proper warm-up. Most acknowledge the need to increase oxygen and blood flow to muscle tissue, to progressively increase contractile activity and range of motion, and to ensure that all the muscle groups receive sufficient attention. More recently, dance educators have come to understand the need to prepare the neurological system

for dance activity, that is, to give warm-up material that is dance specific, rather than general activities that succeed in increasing heat and blood flow to working muscles. A more subtle issue in terms of neurological preparedness is the dynamic or qualitative range that the artistic style of the class may embody. Most well designed classes have a warm-up that encompasses the dynamic range of the class activities. For example, if the main lessons and traveling material of the day are based on free flow and swing dynamic, it would be to the students' advantage to begin preparing the neural system during warm-up to function in this manner.

Second, dance educators are becoming more aware of how the overload principle applies to dance training. The overload principle states that to improve levels of muscular strength or endurance, a muscle must be stressed beyond its capacity by work loads placed on it, and this increase should be done in gradually increasing degrees (Arnheim, 1985; Clippinger-Robertson, 1988). Starting the year with classes that take into account summer "de-conditioning" is one way teachers can be aware of gradually increasing the physical demands. Organizing the material over a term with less strenuous work developing over time into more strenuous work is another way of applying overload ideas. It is also useful for teachers of the same group of students to discuss their class plans. By sharing ideas about what new material will be covered, educators can avoid a sudden leap in intensity that can cause damage to unprepared bodies. For example, if two teachers of the same group were both to increase jumping material in the same week, the results could be a rise in shin splints rather than the desired increase in strength and skill development.

Third, the pacing and arrangement of material is another important aspect of a well-designed technique class. From warm-up through center work to traveling material and cool-down, the flow of activities must contribute to the overall progressive experience. Placing too many highly complex and long exercises early in the class can have negative consequences. First, the student may have difficulty focusing on proper execution of the material if he or she is overwhelmed with remembering sequencing. Second, if the teacher has to demonstrate each exercise numerous times early in the class, the students may never get properly warm, due to long periods of observing between each movement experience. Third, if the early portion of class is composed of highly complex, lengthy movement sequences, the student may experience mental fatigue during the latter portion of the class. Ideally, the warm-up is sufficiently simple to allow the student time to focus on proper execution and alignment during the given tasks; as the class proceeds, the movement phrases can increase in length, spatial and rhythmic complexity, and artistic demands. Additionally, the well-designed class is organized so that no single, strenuous activity is done excessively. For example, few bodies could tolerate the following class: (1) a reasonable, brief warm-up; (2) a continuous series of exercises involving several variations of rises, such as relevés on two feet in various positions, on one foot, and relevés with and without pliés; and (3) a final section consisting of 45 minutes of various jumps, hops, and leaps with no intervening exercises to allow muscles to recuperate. Educators with a good understanding of the detrimental effects of muscular overuse would not consider arranging a class in this fashion. Finally, class must be organized to find a balance

between discussion of ideas and experience through movement. The student will benefit from both the kinesthetic and the intellectual understanding of the material presented, and the well designed class supports both forms of experience.

Dance Psychology

Dance psychology can offer some valuable insight into managing stress and fatigue in the life of the dancer. The body is highly susceptible to injury during times of stress or fatigue, such as just prior to important performances and during exam times. While there is little research directly related to dancers, the studies in sport psychology support the view that there is a significant relationship between psychological stress and athletic injuries (Bramwell, Masuda, Wagner, & Holmes, 1975; Cryan & Alles, 1983; Kerr & Minden, 1988). Mainwaring, Kerr, and Krasnow (1993) found that the amount of time injured was related to stress, and that as negative stress increased, the duration of injury also increased. The dance teacher who is aware of high stress periods for dancers can prepare lesson plans that are more moderate in physical demands. Additionally, the practice of dramatically increasing rehearsals just prior to performances may well be on the decline as educators realize the possible negative consequence of such a schedule.

Another area of dance psychology, motivational strategies, can also be addressed in dance training. Schneider (1985) claims that it is a fallacy that the repetitive practice of specific skills is in and of itself enjoyable. He asserts rather that concentration and enthusiasm suffer during training if additional motivation is not provided, beyond the suggestion that practicing certain skills will lead to improved dancing. Dance educators can provide motivation in a number of ways, such as adding variety, encouraging student interaction, and allowing periods of time when students can enjoy a level of success with a task.

Motor Control and Motor Learning

Motor control and motor learning research offer invaluable information which can improve the dance technique class while preserving its artistic goals and integrity. Recent studies and literature have examined issues such as alignment, learning strategies, effects of knowledge of results, and the transfer of training. While much of the research has been outside the dance field, there are still relevant points that benefit the dance educator.

The issue of alignment and methods of altering poor alignment patterns have plagued dance educators for as long as dance has been concerned with beautiful lines as one of its aesthetic goals. Recently educators have come to accept the hypothesis that poor alignment increases predisposition to injury and therefore shortens the dancer's career, making the alignment issue even more pressing. In the first part of this century Todd (1937) discussed the link between the body's alignment and how the brain sends messages to the muscles, terming this connection psychophysical. Sweigard (1974) continued to develop these ideas, and her resulting system of Ideokinesis is one of the

major body therapies. Sweigard believed that changes in alignment were only possible through the re-coordination of neuromuscular pathways responsible for habitual muscle balance and the resulting movement patterns. She asserted that if the idea or image of the movement was correct, then the brain is capable of best determining the appropriate muscle groups to use, and to what degree.

By this hypothesis, then, it is the role of the dance educator to present movement and alignment concepts during the dance class in a manner that enables the student to access the most beneficial neuromuscular pathways. The old habits of pushing, twisting, and forcing students' bodies into aesthetically pleasing positions are being replaced by instruction in body awareness, and the use of images in the classroom that allow the mind to re-align the body appropriately. A recent study by Krasnow (1994) suggests that static alignment and dynamic alignment can vary significantly in individuals. It may therefore be more useful to give dancers information and images to use while they are in motion in the class, rather than to spend great amounts of time correcting placement while dancers are standing motionless at the barre or in the center.

Examining issues relevant to the field of motor learning, Skrinar (1988) has described three different learning strategies that various students use to absorb information in dance class: verbal, visual, and kinesthetic. She asserts that the most effective teaching approach relies on instruction that uses all three strategies, rather than focusing on one at the exclusion of the other two. Dance educators who are aware of the diversity of learning styles can give explanations (verbal cues) as well as demonstrating the movement (visual cues). Giving hands-on feedback and using images that encourage the feeling or experience of movement can serve as kinesthetic cues. By utilizing a wide range of approaches, the dance educator is more likely to assist the greatest number of students in the learning process.

A second issue in motor learning that has been studied for several decades is the topic known as knowledge of results. Knowledge of results refers to giving students information about how they have performed a task, so that they may improve performance on the next effort. While dance training, along with most athletic systems, involve large amounts of repetitive practice, investigators in the motor learning field insist that it is the use of knowledge of results rather than the repetition that influences learning (Adams, 1987). Further, Adams suggests that it is helpful for the student to receive information about what the movement sequence should be, and additional information about specific successes and/or errors. Most dance educators have witnessed how much faster students progress when given individual and group feedback about what went wrong (error information) and how to improve the next attempt at a combination. It is also likely that giving additional feedback about whether or not the students succeeded in making the corrections would achieve better results, even if a day or two might pass before the combination is to be attempted again.

A third area of motor learning, transfer of training, is perhaps the most difficult to apply in the classroom setting. However, in view of the myriad of conditioning systems and

body therapies being used outside the technique class, it is crucial that dance educators begin to examine this issue thoroughly. One possible approach, as suggested by Sweigard's theories, is to rely on imagery and visualization that achieve not only artistic results, but also facilitate neuromuscular repatterning. Dance educators have for centuries used imagery and visualization to effect qualitative and aesthetic changes in dance movement (Overby, 1990; Smith, 1990; Studd, 1983). The role of visualization during movement to transfer neuromuscular patterns learned in one context to another is only starting to be researched. For example, many of the images used in body therapy work might also be effective when used in dance technique class. Educators are using Alexander Technique's images about the carriage of the head, Sweigard's nine lines-of-movement, and a variety of images developed in the body therapies during dance classes. It may even prove useful to carry over some of the same vocabulary, which could act as a trigger for certain neural pathways.

Anatomical imagery can potentially assist in re-configuring old patterns by setting new goals. For example, Andra Corvino, a ballet teacher in New York, was observed working with a student who had opened her knee in passé far beyond her hip rotation. Rather than tell the student to bring her knee forward, she explained to her that an "open passé" is one in which the support for the passé, the sacrum, is wide and open. The student's attention shifted from her leg to her pelvic support, and the leg moved to correct placement as the student expanded the back of the pelvis.

Finally, the use of images may assist in neural re-patterning when muscle changes are being achieved through traditional strength and flexibility conditioning work. Perhaps a student has been doing hip flexor and lumbar extensor flexibility work and abdominal strength work to correct lordosis, but these physiological changes do not seem to be altering the poor alignment. The educator might try using various images rather than speak about physically re-positioning the body segments. The dance student can then subcortically apply the muscle balancing work done in a conditioning context directly into the development of new movement patterns.

Part-to-Whole Transfer

Another major area of transfer of training is the subject of part-to-whole transfer, described earlier as the practice of a component part of a particular action in order to improve performance of that action (Winstein, 1989). The questions arising from part-to-whole transfer are pertinent to issues of transfer within the class, rather than transfer from a context outside the class. Wightman and Lintern (1985) have defined three types of part-task manipulation: segmentation, fractionation, and simplification. Each of these three types is used with great frequency in the dance technique class.

Segmentation refers to breaking up the larger task into parts, according to spatial or temporal components. An example might be teaching each 8-count section of a larger combination before putting together all four 8-count phrases into one long sequence. One of the advantages of this method is that the more difficult or complex segments can

be emphasized during the segmental practice, and easier sections can be taught quickly.

Fractionation is used when two or more tasks are occurring simultaneously in one larger combination. The educator will often, for example teach a complex phrase that has traveling steps with arms and torso movements, by first teaching the torso and arm movements in the center. Then perhaps only the foot and leg rhythm will be taught as a traveling phrase, and finally all the material will be combined.

Simplification involves making a very difficult task easier by adjusting some of its components. It is common, for example, to teach movement combinations at a slow tempo with a uniform dynamic, and then, upon acquisition, to augment them with variations in tempo and dynamic.

Some of the approaches to part-to-whole transfer used by dance educators have recently come into question. Skrinar (1988) suggests that there may not be sufficient transfer when component material is taught at a much slower timing than it will be used in the actual combination. She also raises the issue of the amount of material taught at the barre or on the floor that educators assume will transfer to traveling material. The principle that may shed light on some of these problems is that of specificity. Practicing a task at a very slow tempo may be too far removed from the actual arrangement of neural patterns that need to be established to achieve the full task. Similarly, the balance and weight shift difficulties in traveling work may make practice of a task while sitting or at the barre ineffective as a training device. What then are some methods that can encourage part-to-whole transfer in these conditions?

Methods

First, the dance educator can assist the dance student in consciously recognizing important connections. Verbal reference to earlier material and how it relates to more complex material can be highly useful in helping the dancer access already learned patterns. If the student is having continued difficulty, it may even be productive to pause during the traveling work, and go back to the floor or the barre, and actually repeat the earlier simpler version.

Secondly, the dance educator can begin to explore contextual variety more, and present familiar tasks in new and varied configurations. A study involving the learning of motor skills was conducted in a university physical education program by Wrisberg and Liu (1991). The results supported several laboratory studies which suggest that contextual variety improves both the transfer and retention of learned skills. Thus, dance educators can begin to explore a greater range of contexts in order to reinforce transfer of skills. For example, if the student has only done leg extensions standing in one place, perhaps trying them in a traveling phrase, changing facings in the room, changing the tempo, and rearranging the order might enhance the learning process. Exploring known material in a different and unusual fashion can improve the learning and retention of skills, and assist the student in transferring these skills to a variety of situations.

The dance sciences have provided the field of dance education much needed knowledge and tools, and at the same time posed difficult and controversial questions about how dancers are trained. Information gleaned from the studies of exercise physiology, dance psychology, and motor control and motor learning can assist the dance educator in developing more effective training within the creative environment. It is a goal of every teacher to provide a safe and beneficial atmosphere for students, and at the same time continue to embrace the artistic goals that have inspired dancers for generations. The challenge is to find the means to bring dance science into the studio, not to replace the art form, but to enhance and support it.

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