

The IADMS Bulletin for Teachers

Volume 3, Number 1, 2011

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Gayanne Grossman, P.T., Ed.M., and Marliese Kimmerle, Ph.D.

Associate Editors

Ruth Solomon and John Solomon

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Letter from the Editors

Dear Dance Educators,

We are delighted at the positive response to the Bulletin which is now reaching a much wider audience due to our liaison with other dance education organizations and the newly formed Studio Teachers' Network. The editors, IADMS Education Committee, and the IADMS Board of Directors wish to extend our sincere appreciation for the continuous generous support of the *IADMS Bulletin for Teachers* by Ken Endelman of Balanced Body.

This issue includes articles on storing momentum, lateral bias (with handout) and screening programs. We hope the content of this Bulletin will help you evaluate your screening and technique class procedures and enrich your teaching practice. We welcome Janet Karin as the new chair of the Education Committee and give our thanks to the outgoing chair, Rachel Rist, for her valuable contributions. It has been a very active committee as you can see by the Chairperson's report and a summary of activities from the Day for Teachers during the 2010 IADMS Annual Meeting in Birmingham, UK. We hope you will join us for A Day for Teachers 2011 in Washington, DC, USA, October 16th. The next issue of the *IADMS Bulletin for Teachers* will provide information on the upcoming program of the IADMS conference and the Day for Teachers, which will also be posted on the IADMS website (www.iadms.org). If you have not explored the website beyond the Bulletin, make sure you look for the new posters and recent resource papers.

We encourage dance educators to continue communicating with us to ensure we answer your questions and address topics that help promote our mission of bringing state of the art dance science research into the dance studio. Please send your letters to: media@iadms.org

Editors:

Gayanne Grossman, P.T., Ed.M.

Marliese Kimmerle, Ph.D.

Letters to the Editors

The primary value of the Network for me has been in the *Bulletin for Teachers*. I have found the content to be informative and directly relevant to the studio. The articles relating to specific technical and physiological issues have been particularly useful, providing a valuable link between researchers, medical professionals and teachers in the studio. I would be interested in further research and discussion on the pedagogy of vocational dance training and the psychology of elite dancers. To me, developments in these areas will be central to the progression of dance as a dynamic and relevant art form.

With thanks,

Tristan Message

Classical Teacher

Love the bulletin and pass it on to other colleagues, and also use it in teacher training scenarios that I lead, to kick start discussion around given subjects. Would really like to see more psychological subjects in all IADMS literature, but especially the bulletin—perhaps strategies to support given concepts such as self esteem, confidence, anxiety, etc., but also how to support positive psychology amongst staff, students and all involved?

Elsa

Dance Teacher

Education Committee Activities

Greetings from the Chair of the IADMS Education Committee

In following an exceptionally imaginative and hard-working leader, Rachel Rist, as Chair of the Education Committee, I have inherited a lively, creative committee and a cauldron of initiatives designed to bring dance science to all those who teach and care for dancers. One of Rachel's salient successes is, of course, the IADMS **Bulletin for Teachers**, edited with extraordinary skill by Gayanne Grossman and Marliese Kimmerle. I am sure you will agree that this achievement alone would be ample evidence of Rachel's contribution over the last four years.

By now, many of you will have enjoyed the Day for Teachers in Birmingham, UK. While Donna Krasnow, Chair of the **Day for Teachers** program sub-committee, is commenting on the event in this issue, I wish to congratulate Donna for a beautifully planned sequence of presentations, engaging speakers and topics that affect us all in our teaching lives. I happen to know that the tireless Donna has our 2011 program well under way, so make your plans to come to Washington, DC, USA, to take part in this most enjoyable professional development opportunity.

In Birmingham we released our new set of posters for 2011. A constant stream of teachers greeted us, trying to choose which of the total of **six full-color posters** would be most useful in their studios. Finally, many people found the choice too hard and bought the full set of six. With their excellent design and witty, expressive images by New York-based dance photographer Jake Pett, these striking posters bring style and information to any studio or clinic. Each poster is based on an IADMS resource paper (under Resources/Resource Papers on the IADMS website), allowing teachers to gain a greater understanding of each topic. The "Somatics" poster explains how dancers can use imagery and attention, or "mindfulness," to improve their performance, even when injured. The "High Performance Fuel" poster can be the dance teacher's secret weapon in encouraging students to consider the vital relationship between nutrition and performance. The "First Aid for

Dancers" poster is another indispensable asset, giving easy-to-follow emergency information on dealing with injuries as well as advice on ensuring a safe return to dancing. Of course, you can still purchase "Starting Pointe Work," "Proprioception" and "Adolescent Growth Spurt." All posters are available through our website. They can be purchased separately or as part of your enrolment in the **Studio Teachers' Network (STN)**.

Education Committee members recognize from personal experience that dance teaching can be a lonely business, and sharing our problems with our "significant others" at home over dinner does not necessarily answer our questions on technique, physiques, flexibility, injuries, growth spurts, etc. The STN has been formed to enable teachers to communicate with others with similar interests and, inevitably, with similar problems. If you plan to travel, you may also want to contact teachers in the areas you will visit. As the STN is a new venture, we will soon be surveying those enrolled to find out how we can meet their needs. To enroll in the STN and receive other benefits such as discounts and email news, simply purchase the three 2011 posters and send your details for listing in our online directory (Resources/Studio Teachers' Network).

The Education Committee is also busy supporting the new **IADMS/Trinity College London Certificate in Safe and Effective Dance Practice**. This qualification is rapidly becoming acknowledged internationally for its comprehensive, scientifically sound content, for its applicability to the teaching situation and for the user-friendly format in which it is delivered. The qualification assures parents and students that you are complying with international "best practice."

As you can see, Rachel's example of energetic innovation is both inspiring and challenging. I look forward to both aspects, and to serving you all as you "plant seeds of knowledge that last forever."

Janet Karin
Chair, IADMS Education Committee

Report on A Day for Teachers 2010

The theme for the 2010 Teachers Day was “Safe and Effective Dance Practice.” The material presented was useful to teachers of a variety of dance forms and age groups, and also had application to the IADMS/Trinity College London certification/qualification in Safe and Effective Dance Practice. Donna Krasnow opened the day with an overview of anatomy and alignment from the dance teacher’s perspective, covering some of the common muscle imbalances and alignment faults seen in dancers. Rachel Rist followed with a discussion of sequencing the dance class, looking at some of the factors that determine when and how material should be introduced to dancers, and how dance classes might be organized in terms of healthy development of the dancer. Emma Redding covered a range of topics from injury prevention and management, to training approaches that minimize overuse injuries, to first aid, to some of the latest rehabilitation approaches.

Ginny Wilmerding examined healthy environments, describing room factors such as floor surfaces, temperature, and ceiling heights, as well as promoting good hydration and nutrition for dancers. Jan Dunn gave an experiential session combining imagery and movement, with a focus on the feet and the spine. The last session led by Maggie Morris and Sonia Rafferty was a discussion of IADMS/Trinity College London certification/qualification in Safe and Effective Dance Practice, with a focus on information for potential course providers. The day ended with a panel of all the presenters fielding questions from the attendees. “A Day for Teachers” in Washington, DC, USA, in 2011 will examine supplementary training - fitness for the dancing body. Please join us for another exciting and informative day of presentations and movement sessions for teachers!

Donna Krasnow
Program Planning Committee

Storing of Momentum in Ballet Movements

Kenneth Laws, Ph.D., Professor Emeritus of Physics, Dickinson College, Carlisle, Pennsylvania, USA

Suppose you are preparing for a day-long trip by car, and you want to be prepared for anticipated needs, such as thirst. You would probably take with you a bottle containing enough water to satisfy your thirst through the day. You would want a secure container to avoid spillage.

What, you ask, does that have to do with science principles applied to dance movement?

Well, replace “water” with “momentum” and you have a very viable analogy. There are instances in which you generate rotational momentum but, rather than using it at the moment it is generated, you want to store it for use at a later time. Consider, for example, a partnered “whip turn,” in which the turning momentum is generated by forces from the partner on the ballerina’s waist, with the ballerina starting in pirouette position rather than a preparatory position with both feet on the floor. When the partner exerts forces on the ballerina’s waist, say the right hand pulling back and the left hand pushing forward, rotational momentum is generated, producing a rotation clockwise when viewed from above.

Now, if the ballerina remains as a rigid body in pirouette position, the forces from the partner will produce a rotation, but the magnitude of rotational momentum will not be very great, as the partner’s hands cannot continue pulling and pushing after the ballerina has rotated away from her initial position. Thus, the total rotational momentum generated is limited.

But suppose the ballerina starts with the gesture (right) leg horizontal and oriented about 45 degrees to the left of front, and then rotates the horizontal leg around to face right while the forces are being exerted on her waist. Then the rotational momentum generated by those partner forces is stored in that rotating leg rather than in the body as a whole. Note that the momentum, like the water stored in the bottle, is stored in the leg for use at a later time. In the dancer’s case, the momentum was stored for use gradually, as the friction of the supporting foot on the floor would otherwise gradually destroy the momentum.

Because the leg carries significant mass, and much of that mass is carried far from the vertical axis of rotation when rotating, it can carry a significant magnitude of rotational momentum. When the rotating leg reaches an orientation directed toward the dancer’s right, still in the horizontal plane, it transfers its accumulated rotational momentum to the body as a whole, producing a very effective rapid turn rate for a pirouette, possibly eight or ten revolutions in magnitude!

Another movement that employs the same physical principles is the fouetté turn sequence. That, like the partnered “whip turn” previously analyzed, uses the gesture leg as a rotating mass storing rotational momentum. In this case, however, the turning movement is continuous, with the body gradually losing momentum through friction between the supporting foot and the floor. Once each revolution, however, the supporting foot is twisted against the floor in a direction that allows the twisting force from the floor acting on the foot to contribute an amount of rotational momentum that just replenishes that lost to friction during the preceding turn. The turning movement is continuous, but varies with time, from a maximum following the twist from the floor on the supporting foot to a minimum when some of the momentum has been lost to friction. A proficient dancer can keep doing these turns to a total of perhaps 32 revolutions, as in a popular version of the “Black Swan” solo from “Swan Lake.” And, once again, it is made possible by the storing of rotational momentum in one leg, in this case being transferred back and forth between that leg and the body as a whole.

Be careful, however! There is another form of fouetté turn that employs an entirely different physical principle to accomplish an apparently quite similar result. If during the sequence of turns comprising the fouetté turns the gesture leg is not brought to the horizontal position facing to the left of straight forward so that it can rotate from left-front to right, storing momentum as it carries out that rotation, but instead merely extends to the right from the *pirouette* position to “second position,” then the rate of turn will



slow down because the moment of inertia has increased because the leg is extended. That slowing of the turn rate allows the supporting foot enough time to come off pointe, exerting the twist against the floor that creates the additional momentum to replace that lost to friction, thereby keeping the rate of turn high.

Thus, fouetté turns can be performed either by storing momentum in the gesture leg while the supporting foot

does its job of twisting against the floor to generate the added momentum needed to keep the turn going, *or* the gesture leg is merely extended to the side, thereby increasing the moment of inertia of the body, resulting in a slower rate of turn which allows the supporting foot to twist against the floor, generating the additional momentum to keep the body from slowing with time. The final result in both cases is to allow the dancer to maintain the rate of turn to



stay with the music and keep the energy in the movement.

Now let's go back to a normal pirouette, in which the preparation position has one foot well behind the other, so that when the two planted feet push in opposite directions they produce a rotational torque that causes the turning movement to start. What role does the upper body play in this process?

Note that, for a turn to the right, instinct leads us to rotate the right arm toward the front and around to the right side as the turn is initiated. Does that movement of the arm, sometimes called a "windup," contribute positively to the effectiveness of the turn, or does it merely compromise the aesthetic quality of the pirouette? Apparently the arm does indeed make a useful contribution, in that it stores some rotational momentum such that when it stops rotating relative to the body it contributes its momentum to the body as a whole. The magnitude of contributed momentum, however, will be significantly smaller than that stored in the leg, as the arm's length and mass are smaller than those of the leg.

Suppose you are now asked to jump vertically from rest to as great a height as you can achieve. What technique do you use? First of all, you would not try to jump from straight knees, or without flexing the ankles. You would probably crouch as you prepare for the jump, and, significantly, you might prepare to thrust your arms from a low position to a level high above your head.

What might be accomplished by thrusting the arms overhead while accelerating your mass vertically upward? As you exert as great a downward force of your feet against the floor as possible, the floor is exerting an equal upward vertical force against your feet. If that is the only vertical

force acting on your body besides gravity, it will determine the magnitude of vertical acceleration of the center of mass upward. But the location of the center of mass in the body will be rising as you bring your arms from a low position to above your head. In fact, those arms are accelerating upward, gaining vertical momentum as they accelerate. When the arms reach their maximum height relative to the rest of the body, their velocity relative to the body will quickly return to zero, and the arms will remain in a constant location above the head. But in the process of slowing down their relative speed, they will transfer their vertical momentum to the rest of the body. Momentum that has been stored in the arms while they were accelerating upward relative to the rest of the body is returned to the body as a whole when that relative acceleration ends. Thus, once again, momentum stored somewhere in a part of the body is brought out and used later to supplement what was in the body before that transfer.

In all of these cases of momentum storage, if the "container" is "leaky," there is a loss of effectiveness in the process, and the movement itself might be compromised. The timing of the movement is important, as seen in the whip turns analyzed here. If the leg rotates from left/front of the body around to the right side before the partner's forces have done their job, the contribution of that leg rotation to the total rotational momentum will be out of phase, and the total momentum will be less than it would be had the movements occurred with a more synchronized timing.¹ The importance of synchronization can also be seen in the "wind-up" with the leading arm as a normal en dehors pirouette is initiated.

In the movements analyzed here it has been shown

that, if the timing is carefully controlled, momentum can be generated that adds to the momentum resulting from the basic movement itself, resulting in a more effective performance.

¹This insight is credited to Kelly Fahnestock, a ballet teacher from Pennsylvania.

Glossary

Acceleration. Rate of change of velocity.

Axis of rotation. The line around which a body rotates.

Force. The magnitude and direction of “push” or “pull.” The total of the forces acting on a body determines its rate of change of momentum.

Mass. The inertial resistance to a change in linear motion. A large mass will accelerate less in response to a particular force than a small mass.

Momentum. A quantity of motion, quantitatively equal to the product of the mass and the velocity of a system.

Rotational momentum. A quantity of rotational motion;

the product of the rotational inertia and the rotational velocity.

Torque. “Turning force.” The magnitude of torque determines the rate of change of rotational momentum. The magnitude of torque for two forces acting in opposite directions and separated by a distance D is just F times D .

Velocity. Rate of change of position, with magnitude and direction both specified.

This paper is based on material found in *Physics and the Art of Dance* by Kenneth Laws and Momentum transfer in dance movement – vertical jumps: a research update by Kenneth Laws and Caren Petrie. The specific references can be found in the suggested reading list.

Suggested Reading List

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Lateral Bias in Dance Training

Marliese Kimmerle, Ph.D., Professor Emerita, University of Windsor, Ontario, Canada

In the current focus on dance wellness a serious effort is being made to provide the kind of safe and effective training that produces a healthy, physically and psychologically “balanced” dancer. The degree of structural and functional asymmetry of the dancer, the lateral preferences of the dancer in performing certain dance skills, and the possibility of laterally biased dance experiences all need to be taken into consideration as part of the total picture of dance wellness and proper training.

Some of the major technical requirements for a dancer are: static and dynamic stability, most often on only one leg; a good range of motion in specific joints to create an aesthetic line in the gesturing leg and in the upper body; leg strength for take off and landing; and the ability to turn efficiently. In an ideal world, dancers would be totally balanced in their physical and technical training on both sides of their body. They would be able to perform any of these dance tasks equally on either leg and to either side, and thus provide a “perfect,” symmetrically balanced instrument for the choreographer. Realistically, it is more likely that a trained dancer has an asymmetrical body structure, a preference for learning and performing specific skills on one leg or one side, and a dance technique that is functionally asymmetrical—that is, dance skills are performed more proficiently on one leg or side than the other. Assuming that a more symmetrical dancer is desirable, this topic of enquiry is surely of much interest to the dance educator, as is the extent to which asymmetry may be preventable.

It is difficult to determine whether preference results from pre-existing structural asymmetries on the one hand, or causes structural asymmetries or performance differences due to unbalanced usage on the other. This is ultimately a “chicken and egg” question that is explored in more depth in the article from which this one is taken.* In this article a more limited set of questions is examined; Do dancers arrive at a dance class already biased? Do dancers learn faster on one side than the other? How automatic, or how difficult, is transferring the skills learned

on one leg/side to the other? Does the typical dance class increase or balance out that bias? Finally, what role can dance educators, therapists, and the dancers themselves play in identifying these biases, thereby helping to develop a healthy balanced body?

Lateral Preferences

As a population, we have an eye and ear dominance and a preference for which hand and foot we use in fundamental motor skills, with about 90% of the population being right handed and about 80% right footed. An initial innate bias for one side or the other is reinforced by practice, and so it is not surprising that these biases are also reflected in skill levels in a variety of hand skills, foot skills, and fundamental motor skills. At the time of school entry a preference for handwriting, throwing, hopping and ball kicking has been established in most children.^{1,2} Children live in a right-biased world, where play, sport, and activities of daily living tend to be spatially orientated to a cultural right preference. Therefore, many motor skills are practiced more on one side than the other, and it is not surprising that this promotes more proficiency on one side; that is, there is a functional asymmetry in many motor skills. We can assume that dancers would follow the population norm, and thus have lateral biases for performing dance skills and show performance differences. Consensus in the literature suggests that the mobilizing limb—i.e., the limb used to manipulate an object, as in kicking a ball or starting up stairs (or in dance terms, the gesture leg)—is considered the dominant or preferred leg, and the posture stabilizing leg is the non-dominant.^{1,3} The degree of difference between the two sides, however, is dependent on the motor task being done, and the choice of which foot to prefer in a particular task is influenced by the complexity of the task and the interrelationship of the stabilizing and mobilizing leg.^{1,3} For example, if we are only performing a unilateral skill such as standing on one leg we tend to use the preferred leg; however, if we perform a bilateral skill, such as kicking or some other

difficult action with our free gesturing leg, we tend to switch the support leg so our preferred leg can attempt the more difficult action.

This collaboration of the balancing and gesturing legs in many dance skills makes identifying a dancer's "preferred" or "dominant" leg or side somewhat difficult. Which leg do we label as "preferred," the support leg (thereby focusing on strength/balance) or the gesture leg (range of motion)? Two studies^{4,5} with university dance students explored lateral preference. Students were asked to identify right, left, or no preference for performing a number of fundamental motor and ballet skills. In the first study right preference for specific skills ranged from 90% to 45%, and in the second study, using slightly different skills, 95% to 18%. These percentage ranges are based on how challenging the balance, propulsion, or shock absorption function of the supporting leg, or the flexibility and range of motion of the gesturing leg, are. Although there were large individual variations between dancers, some overall patterns emerged. Strong right turning preferences were identified in both studies,^{4,5} but this right bias did not necessarily carry over to other skills, which varied between right and left. A right preference for balance was evident when balance was challenged (as in piqué).⁵ When range of motion (ROM) was the issue, however (in battement à la seconde and ronde de jambe),⁵ the balance preference switched to the left leg. Range of motion, therefore, apparently overrides balance demands. It is likely, however, that each dancer has to negotiate her own trade-off between balance, strength, and flexibility, depending on body structure, past training, and injury history.

The results of both studies suggest that identifying a dancer's lateral bias is a complex matter, and the choice of dance skills used in evaluation becomes critical. It is also important to match the choice of skill to the dancer's ability level. To get a complete picture one must evaluate a number of components, such as: spatial direction of turning, both on the spot and traveling; take off and landing legs in jumps; range of motion and flexibility of the gesturing leg; and strength of the supporting leg when a balance task is difficult or the gesturing leg has to be held in the air for a long time.

Why assess a dancer's lateral preferences? Preferences can potentially affect the learning of new skills and how much skills are practiced on the non-preferred side. These in turn will affect how well the skills are performed on either side, and how the muscles and joints respond to a potential imbalance or overload. The bias may be compounded by a laterally-biased class.

Learning and Transfer

Given a population preference for performing hand and foot skills on the right, it is not yet known whether one also learns better on the right side. To explore that question researchers have typically presented a novel hand skill to be learned first on one side and then transferred

to the other. Magill has identified some of the arguments proposed for either side.⁶ For teaching right-transfer-left, it could be argued that it is easier to learn a new skill with one's well skilled, highly refined side. One should learn faster on the right, and the motor program would more easily be transferred to the left side. The counter argument, however, is that while it may initially be more difficult to perform a novel skill on the non-dominant side it is processed at a deeper level, and therefore when the newly learned skill is transferred to the right, the more "competent" side will achieve a higher transfer performance. The results of numerous hand transfer studies were inconclusive.⁶ There was no consistent right or left hand learning preference. Results depended on the type of task studied.

It is not surprising that some dance instructors and researchers have been intrigued by the transfer question, as learning and then transferring skills and combinations from one side of the body to the other is such an integral part of the dance class. There is unfortunately sparse information to settle this question for the dance class. Initially learning and then becoming competent in a novel, physically difficult skill, such as a new turn or jump or balance skill, involves learning the actions involved, but the actual level of skill attained is also dependent on the existing strength, balance, range of motion and control of one limb compared to the other. Any difference found would not necessarily be due to one side "learning" the skill better. This fact has made studying right/left learning in dance difficult and inconclusive.

Differences in "learning" can perhaps be demonstrated more clearly by presenting a novel sequence that does not include any physically demanding skills. A recent study⁷ was undertaken to evaluate the effect of lateral presentation and dance experience on the learning and transfer of dance sequences. Forty females, 20 novice and 20 experienced dancers, were videotaped attempting to learn two dance sequences, presented either to their right or their left side and then transferred to the opposite side. There were no differences between the right and left learning groups for the initial, practice, and transfer trials for either novices or experienced dancers, although the left learning groups took more time to learn the sequences.

The lack of difference for left side learning for both beginning and experienced dancers is noteworthy, considering the general right preference for performing many dance skills and the typical right biased dance class. It is important to point out that in this study the demands were largely cognitive. What was measured was learning, not performance. Participants were scored on being able to move continuously through the sequence with the correct steps in the right order, following the demonstrated directional pattern. They were not scored on technical form; rather, learning in this instance represented a memory challenge. This study does suggest that learning capability may not be detrimentally affected by sometimes starting the class on the left. Whether the skill level eventually

reached will be balanced on both sides is an open question, and will be influenced by how much practice is provided for either side.

Teaching Biases

A quick glance at a sample of the traditional dance texts on any reader's shelves will likely show a model performing a dance skill while gesturing with the right leg—in *batterie*, *développé*, or *arabesque*—with the accompanying description of the steps starting with the right foot or the right side. One can assume that dance teachers would also be influenced by a bias, and may tend to favor the right side. This might include demonstrating and initiating practice on the right, giving more practice to the right, and presenting combinations on the right and then expecting them to be transferred to the other side with little extra instruction or marking. Two studies of dance classes demonstrated that this right bias is common.^{8,9} In the first study students were asked about their expectations for a teacher starting various sections of class on the right or left side/foot. Results were 66% right for the barre part of the class, 85% for the center work, and 85% for the adagio. Seventy-six percent expected that the adagio would be repeated on the other side, but only 12% expected it to be re-demonstrated.

In the second study, observing ballet classes, the number of repetitions favored the right, with up to a 26% higher prevalence of right over left.⁹ The right bias increased with advancement in class level. Although anecdotal reports from teachers suggest that some are experimenting with starting on the left or alternating sides from day to day, there is also reluctance to deviate from students' expectation of starting on their comfortable and preferred right side.⁸ A self-evaluation format might be useful for instructors to quantify their own bias, and as a tool in pedagogy courses to generate more data on class bias in different dance forms and different class levels.

The proposition has to be entertained that dance training can either exaggerate an already existing bias or help reduce it. Dancers' preferences and the amount they practice will interact with their ability to learn lateralized skills. How might biased practice influence learning? The performance of most skills is dependent on neuromuscular control, not simply on physical parameters. The height of a leg in a *la seconde*, or the balance on *relevé*, is certainly dependent on more than muscular strength or range of motion. The degree of motor control we have in either limb would certainly be affected by how often we practiced skills on one side or the other. Learning is no doubt also affected by our perceived competence at performing skills on one side or the other. Anecdotal reports in the transfer experiment mentioned previously suggested that many students exhibited or reported some lack of confidence in their ability to learn the sequence when it was presented to the left side, as well as surprise at how effectively they were eventually able to learn it.⁷ This issue of perceived competence on one leg or the other may also be a developmental issue. If extra effort were made to offer more laterally balanced

experiences to young dancers would a more balanced older dancer emerge?

Choreography

A final question to be explored, but not by the movement scientists, is the role that preference and asymmetry play artistically. There are many historical examples of great dancers and major pieces of choreography that were laterally biased in, for example, lengthy turning sequences. On the other hand, a member of the *corps de ballet* can't say to the choreographer "I don't like doing my turns from that side of the stage." Although there are exceptions, in the world of sports one does not ask a high jumper or a pitcher or tennis player to perfect his skill on either leg or both arms. However, the demands of dance are aesthetic, and surely a balanced instrument is a necessity. Is lateral bias and functional asymmetry an advantage or disadvantage in a performer's life, or is choreography also biased in order to adapt to this reality? That last question is one only the artistic dance community can answer.

Conclusion

The novice dancer likely brings to his/her first dance class some structural asymmetries and differential proficiency in lateralized motor skills, along with a distinct preference for learning and performing skills on one side. The dancer may then be exposed to teachers who also have asymmetries and preferences, and to class content and traditional teaching methods that potentially provide further laterally biased learning experiences. In the worst-case scenario this could produce a strongly biased, potentially injury-prone dancer, who is laterally limited as a performer. Dance educators and therapists can play an important role in identifying biases and asymmetries. The ideal outcome of a well considered training program that attempts to balance any asymmetries would be a functionally balanced, healthy, and choreographically versatile dancer.

*This article is adapted from: Kimmerle M. Lateral bias, functional asymmetry, dance training and dance injuries. *J Dance Med Sci.* 2010;14(2):58-66.

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IADMS Education Committee

The IADMS Bulletin for Teachers Handout 3(1) 2011



Lateral Bias Self-Evaluation

For the Teacher:

- When I teach a new skill is it always presented to the dancer's right leg/side first?
- How many practice repetitions do I give on the right and left side?
- Do I assume dancers can automatically transfer a combination from one side to the other?
- Do I help them mark a new skill or pattern on the second side?
- Am I aware of my own lateral preferences, and are these reflected in the way I choreograph combinations?
- Am I observant of the dancers' strong and weak sides for different skills?

For the Dancer:

- Do I have clear preferences for performing certain skills on my right/left leg or side?
- Is there a large difference in performing skills on either side?
- When I practice new skills on my own do I practice more on my "good" side?
- When I am standing waiting for class, on which leg have I placed my weight?
- Have I learned any strategies to help me figure out how to transfer combinations from one side to the other?
- When I choreograph my own dances is there always the same lateral bias in the skills or the floor pattern?
- What is the difference when I learn a new combination with and without a mirror as a visual reference?
- How well do I cope with the change in visual space from studio to stage?



Screening for Improved Dance Function

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*“When you do dance, I wish you
A wave o’ the sea, that you might ever do
Nothing but that.”
William Shakespeare*

This simple quote represents the deep feelings that many teachers have for their students of dance – a wish, in a sense, that one could dance forever with ease, minimal problems, and injury free. Freedom to a dancer, as Martha Graham stated, “...means discipline. That is what technique is for – liberation.”¹ This liberty is the result of motivated pursuit, year after year, aspiring to perform with skill, grace, and efficiency, attributes that may be considered the ultimate in physical expression. Dancers strive to dance, as Isadora Duncan said, with “highest intelligence in the freest body”² for as long as possible. And, it is dance teachers who play a critical role in their students’ accomplishments.

Enter Dance Medicine, Dance Science, and Dance Screening

Imagine a world where dancers are able to learn specifics about their physical condition similar to what commonly occurs with other athletes. Then imagine that by performing some simple exercises given by the teacher and/or a team of medical professionals cognizant of the unique demands of dance, the dancer happily reports later that many of her basic dance skills have improved and she generally feels better about herself and her dancing. These worlds do exist, and new ones are being created by dedicated teachers and medical professionals in dance companies, schools, conservatories, and universities.³⁻⁵

As is the case with modern fact finding, dancers use the internet to get information about various issues related to dance, health, nutrition, anatomy, and injury prevention, and are also learning about the value of wellness and screening.⁶ They are also becoming aware of the growing number of medical professionals who are conducting research in dance medicine and science and are dedicated to helping dancers train more effectively and efficiently and dance longer. In many countries there is an emerging trend toward preventative medicine in health care systems that involve screenings. The implementation of dance screening has immediate and potentially long term

benefits for dancers.

So what is dance screening and why do it? A typical dance screen is a series of tests designed to assess the overall well-being and functional capacity of dancers. The data collected are used to provide a physical, medical, nutritional, and/or psychological profile for each dancer. The results of a screen can help teachers and other dance professionals enable dancers to realize their full potential, and may also “help detect potentially life-threatening or disabling medical or musculoskeletal conditions that may limit a dancer’s safe participation and help to detect medical or musculoskeletal conditions that may predispose dancers to injury and/or illness during their season.”⁷ More importantly, many professionals have suggested that screening can play a role in enhancing a dancer’s ability and may help them change patterns of movement that might result in stronger bodies and better dancing.⁸⁻¹⁰ It is very important that screens are **NOT** used as a test of acceptability into a company or school. Rather, at the very heart of contemporary approaches to screening is the goal of providing a set of tools to support dynamic interactions between dancer, teachers, and other professionals for the benefit of the dancers.

What Goes Into a Functional Screen?

There are many different screens in use by various professional companies and schools. Basic tests and measures can be used to assess and improve dance function for teachers, schools and health care professionals who work together as a team but do not have screening experience. Common components of a screen include orthopedic assessments that examine a dancer’s overall structure, strength, flexibility and laxity. Also commonly included are various functional components such as dance technique or related movement-based assessments intended to help identify areas where a dancer may benefit from refinement exercises or changes in motor patterning that can be done during or outside of the technique class. Tests that examine balance and general cardiovascular fitness are

also conducted, given that these are part of most training and performance demands.

Components of a Functional Screen

Well designed screens may identify deficiencies which, once corrected, may improve function. The goals of a screen and many specific factors may influence the type of screen that is appropriate and the number of assessments that can be feasibly included. The screening team may include physical therapists, athletic trainers or other equally qualified medical professional, dance teachers, and movement science researchers. In some cases students may be trained to screen as part of an educational component.¹¹

Planning for what to do with the data that are collected is very important, and screening teams should discuss in advance how this information is to be used. Confidentiality of all screening information is paramount. Therefore, the screening team should decide in advance who is to have access to what information. Prior to any screen dancers must be fully informed of the following: 1) what is going to happen, 2) what information is being collected, 3) how the information is going to be used, and 4) who will have access to this information. When dancers are minors, this information must be disclosed and agreed upon with the parents or legal guardians of the dancer prior to any screenings. One example of a project that addresses all of these issues and is currently available to assist teachers and professionals in screening dancers is the Dancer Wellness Project (DWP).¹² On the web site there are sample screens that can be customized to suit individual needs.

A Starter Functional Screen

Through a collaborative effort of experienced wellness professionals, a “starter” screen was designed to support the needs of those people initiating their respective screening programs. This screen includes assessments that can be performed by dance educators who have a basic understanding of kinesiology or anatomy, along with assessments that can be performed by a physical therapist, athletic trainer, or equally qualified individual who may not have experience working with dancers.

A starter screen could include the tests and measures listed below. These were chosen because attributes or deficiencies in these areas affect dance function and performance. Once the screeners become experienced, they will begin to recognize successful movement patterns or impairments. Additional tests and measures can be added as necessary.

- I. TECHNIQUE: look for attributes or faulty movement patterning
 - A. Parallel position to first position
 - B. Demi-plié in first position
 - C. Grand plié in first position
 - D. Relevé in first position
 - E. Passé balance flat
 - F. Développé devant, à la seconde, derrière
 - G. Single pirouette en dehors

- H. Port de bras first to fifth and first to second
- I. Jumps in first

- II. FITNESS
 - YMCA 3-minute step test
- III. BALANCE TEST
 - 60-second stork test
- IV. STRUCTURAL
 - A. Anterior
 1. Iliac crest alignment
 2. Leg length
 3. Knee alignment
 4. Tibial torsion
 5. Morton's short toe
 - B. Lateral
 1. Forward head
 2. Shoulder alignment
 3. Kyphosis/lordosis
 4. Pelvic tilt
 5. Genu recurvatum
 - C. Posterior
 1. Head tilt
 2. Shoulders level
 3. Scapular winging
 4. Scapulohumeral rhythm
 5. Adams forward bend test
 6. Foot alignment
 7. Hallux valgus
- V. STRENGTH: general movement patterns or synergies
 - A. Serratus anterior
 - B. Trapezius
 - C. Rhomboids
 - D. Quadratus lumborum
 - E. Upper and lower abdominals
 - F. Hip internal/external rotation as well as abduction and adduction
 - G. Gluteus medius and maximus
 - H. Flexor hallucis longus
 - I. Peroneals
 - J. Foot intrinsics
- VI. FLEXIBILITY/LAXITY
 - A. Turnout
 1. Total turnout
 2. Standing - floor and discs
 - B. Beighton score
 - C. Range of motion(ROM) & special tests
 1. Cervical spine ROM
 2. Trunk spine ROM
 3. Shoulder and scapular ROM
 4. Thomas test
 5. FABER
 6. Hip internal and external ROM
 7. Knee ROM
 8. Knee ligaments
 - a) Lachman's

- b) Valgus stress
 - c) Varus stress
9. Ankle ROM
10. Hallux rigidus

Post-Screening: Applying the Results

A successful screen must include a post-screening follow up with the dancer. The teacher and/or medical professionals on your team should meet with each dancer to help frame the information for the dancer, educate them as to the findings about themselves, and help them develop realistic strategies to address the areas where they can improve. At first this may seem like a lot of additional work, but immediate benefits for the dancer are significant.

It is important to keep in mind that a dance teacher may be an impacting figure during a dancer's years of training, and may be the individual who notices potential issues. However, while student dancers may be trusting of their teacher's feedback in technique classes, they may not feel comfortable with that teacher knowing other personal details. After all, the teacher may make casting choices or be responsible for advancement from one level to another. Therefore, if a teacher has access to a dancer's screening profile, the information must be carefully used so as not to make casting/placement or similar important decisions solely based on screening profiles. Anecdotal evidence suggests that dancers are more interested in participating in screens if they know the screen is designed to help them become better dancers and that it will not be used as a tool for judgment.

An observant and concerned teacher who has participated in screenings can help a dancer by interfacing with other professionals when appropriate. In the long run, teachers and medical professionals, together, can help to bridge the science of the art and the art of the science for the dancer's benefit.

Immediate Outcomes of Screening

- Each dancer receives a profile of their screening results. The information is useful to a teacher and associated health care professionals in assisting individual dancers with their training and technique goals. A personalized conditioning/intervention program aids in developing efficient and effective cross training.
- Screening can help teachers and administrators augment the dance curriculum to better meet the training needs of groups of dancers.
- Repeated screenings can help track changes for individuals and groups, which can be especially helpful in pre-professional dancers.
- Screenings introduce dancers to the concepts related to their own bodies, which for some dancers may be the first time they have understood their bodies in this orientation.
- Screening results may contribute to the greater body of scientific knowledge of dancers and thus

may be of use in research efforts, the results of which can ultimately impact dancers and their teachers around the world.

Summary

Screenings are valuable tools in the training, education, and care of dancers. During the last two decades the field of dance medicine and science, and specifically that aspect related to screenings, has rapidly become a distinct area of interest, and the development of screening programs at many schools and dance companies is a testament to this growth.

A Screening Checklist

1. Below is a list of some issues/questions to consider when designing a screening program
2. Be clear as to why you are screening and what you hope to accomplish.
3. Identify who can assist in conducting your screen. It is important to have a dance specialist (such as a teacher) and at least one medical specialist (such as a physical therapist, athletic trainer, or equally qualified professional).
4. Based on your team, what can you include in your screen? It is wise to start with a smaller screen and expand and adjust it over time.
5. It is recommended that screenings be conducted at the beginning of a season, school year, or an extended rehearsal period. A screen may take 20 minutes to an hour, depending on the assessments included.
6. Screening data must be treated as confidential information. Be specific on who will have access to the information and why.
7. Consider how you will process the information from the screen, how the dancers will get the results, and how they can be helped in applying this information to their training. Post-screening follow up is very important.

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Abstracts from the Current Literature

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Rafferty S. Considerations for integrating fitness into dance training. *J Dance Med Sci.* 2010;14(2):45-9.

In recent years it has frequently been suggested that dancers may not be sufficiently prepared for the demands of dance, and that the typical dance technique class by itself is not challenging enough to produce fit dancers. While a technique class can focus on muscular endurance, flexibility and neuromuscular coordination, it generally cannot meet all the physiological demands of high intensity aerobic and anaerobic performance. Therefore, supplementary fitness training outside of the dance class is encouraged to meet present day performance demands. This article offers some suggestions for incorporating fitness training into the dance class, and reports on the effectiveness of different supplementary programs. Some cardiovascular overload could be achieved by conducting the warm up at a continuous, higher intensity level and designing longer traveling sequences that are repeated more frequently with less rest time. Supplementary resistance training is also encouraged. Despite the concern that strength training might negatively affect flexibility and aesthetics there is little scientific evidence to support this. However, the training should be specific to the type of movement patterns used in dance. Theraband and dance-specific plyometric (jump) training are two examples of supplementary training. As part of the overall conditioning of the dancers it is also suggested that somatics, motor learning and psychological aspects need to be incorporated into dance training, such as the use of imagery, visualization, neural re-patterning, motivation and goal setting. One also has to consider how much of the outside of class conditioning transfers to the technique class, and therefore the fitness training that is developed needs to be dance-specific. According to the authors it is no longer necessary to ask whether fitness training should be included in a dancer's training, but rather how it can best be implemented.

Richardson M, Liederbach M, Sandow E. Functional criteria for assessing pointe-readiness. *J Dance Med Sci.* 2010;14(3):82-8.

This article is of interest to ballet teachers who are

evaluating dancers' readiness for pointe training and want support for their decisions when communicating with the dancers and/or parents. As background to this research article the reader might refer to the 2009 IADMS resource paper, "When Can I Start Pointe Work?" that can be downloaded free from the website. The resource paper provides some general guidelines for decision-making. The current article provides data on a battery of nine functional tests, and compares it with teachers' evaluation of pointe readiness. The purpose of the article was to investigate whether functional tests can be used in conjunction with teacher expertise to determine pointe-readiness. The authors point out the importance of trunk and pelvic stability through activation of the core musculature, adequate strength at the ankle, and control of proper alignment and balance during dynamic tasks such as turning and jumping. Thirty-seven pre-pointe students were tested and independently graded on readiness by their teachers. Three tests that assess trunk control and dynamic lower extremity alignment were most closely associated with the teachers' subjective ratings: the Airplane test (a dynamic balance test on one leg), the Sauté test, involving trunk and lower extremity control during single leg jumps, and the Topple test, involving controlled landings from single and double pirouettes. The authors suggest that these tests may be more useful than the traditionally accepted criteria of 12-year chronological age, years of dance training, and ankle joint range of motion in evaluating pointe-readiness.

Walker IJ, Nordin-Bates SM. Performance anxiety experiences of professional ballet dancers: the importance of control. *J Dance Med Sci.* 2010;14(4):133-45.

Although it has been extensively studied in sport, performance anxiety has not been well researched in dance. The authors review this research and provide good insight into this problem in the dance world. Fifteen professional ballet dancers were interviewed in order to examine how the type, intensity and interpretation of anxiety

symptoms are influenced by the dancer's experience, self-confidence, and psychological strategies. Anxiety can have somatic symptoms, such as shortness of breath or increased heart rate, and cognitive symptoms, such as worries or negative images. It can have either a positive or negative effect on performance. This qualitative analysis of interviews showed that performance anxiety was experienced by most dancers, but varied in intensity. Not surprisingly, principals appeared to experience greater performance anxiety than corps de ballet dancers, due to increased pressure from demanding roles. Most dancers viewed an optimal degree of somatic anxiety as positive, enhancing the physical performance, but if it became higher it would negatively affect performance. Cognitive anxiety was viewed as having a more negative effect on performance than somatic anxiety. Feeling in control of the anxiety symptoms appeared to be the critical factor. Lack of preparation, injury, and external factors such as costumes, speed of music, stage types and audience members were other factors mentioned that contributed to feeling out of control. External pressures from staff or other dancers, internal pressures to excel and perform well, perfectionism, and self-critical tendencies also contributed to performance anxiety and more general anxiety. The dancers reported that their anxiety was not limited to the actual stage performance but was also present in class and in rehearsals. Extensive quotations in the study provide an intimate look into dancers' anxiety experiences, and perhaps most relevant for teachers of future performers is the description of strategies for preventing or handling performance anxiety through education, the development of coping strategies, and building the dancer's self-confidence.

Okubo Y, Kaneoka K, Imal A et. al. Electromyographic analysis of transversus abdominis and lumbar multifidus using wire electrodes during lumbar stabilization exercises. *J Orthop Sports Phys Ther.* 2010;40(11):743-50.

These authors used wire electrodes to examine the effectiveness of common lumbar stabilization exercises. They compared local and global muscles and side-to-side differences. The authors described local muscles as those that are deeper, considered stabilizers, and attach directly or indirectly to the spine, such as the transversus abdominis and lumbar multifidus. Global muscles, on the other hand, are more superficial, control trunk movement, and do not attach to the spine, such as the rectus abdominis and external oblique. They explain that simultaneous contraction of both groups, known as "coactivation," improves lumbar spinal stability. They investigated several exercises commonly performed by dancers for conditioning purposes: plank, plank with opposite leg and arm raised and reversed, quadruped with opposite leg and arm raised and reversed, bridge, bridge with one leg extended, side plank, side plank with top leg up, and crunch. There are photographs of each exercise. The article includes tables clearly describing which muscles are most active during each exercise. Of interest are the following findings: plank produces the greatest activity of the transversus abdominis and it does not contract as a single unit (rather one side contracts more than the other when the opposite arm or leg is lifted); crunches produce the greatest activity of the rectus abdominis; side plank with one leg lifted produces the greatest right-left difference in the external oblique, but plank produces the greatest symmetrical activity. The article gives specific detail of muscle activation patterns for each exercise listed. This type of information can assist dance teachers in designing exercise programs that target specific muscles.