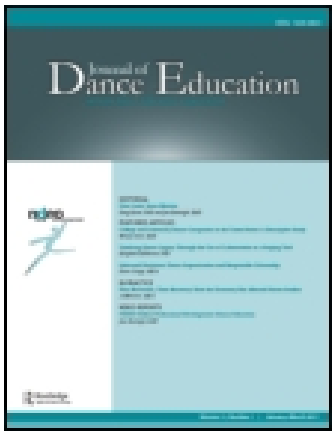

Journal of Dance Education
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/ujod20

# Using Dance to Deepen Student Understanding of Geometry

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Published online: 22 Aug 2012.

To cite this article: Candice Moore MEd & Sandra M. Linder PhD (2012) Using Dance to Deepen Student Understanding of Geometry, Journal of Dance Education, 12:3, 104-108, DOI: 10.1080/15290824.2012.701175

To link to this article: http://dx.doi.org/10.1080/15290824.2012.701175

*Journal of Dance Education*, 12: 104–108, 2012

ISSN: 1529-0824 print
DOI: 10.1080/15290824.2012.701175



***In Practice***

# Using Dance to Deepen Student Understanding of Geometry

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This article provides an example of a collaborative effort between a dance specialist and four third-grade classroom teachers at an arts magnet school. They developed a dance and geometry integration project including implementation strategies, assessment tools, and reflections completed by both the classroom teacher and the third-grade students. The dance specialist and the classroom teacher worked collaboratively to develop an integrated learning experience for students based on national geometry and dance standards. Students worked in groups to create a geometry dance based on selected dance and geometry concepts. Students planned and practiced their dances using a teacher-created rubric as a guideline for including essential geometric and dance elements. The teachers assessed the students' geometry dance performances using the rubric, which included both geometry standards and dance standards and objectives.

Interdisciplinary partnerships are the perfect stage for learning in both subject areas. However, developing and implementing assessment of learning in both subject areas can be a challenge. The goal of interdisciplinary teaching is to equally blend both subject areas so students can experience how different modes of learning contribute to a comprehensive learning experience. In this article the authors describe an assessment process that recognizes the integrity of both dance and geometry as an integrated unit for third-grade students. The following vignette, which occurred in a third-grade classroom, describes how an identified rubric is used by the students as they create and discuss their geometry dances.

Although snow is lightly falling outside the classroom window, students inside work diligently on their geometry dances. Group 1 is utilizing the rubric that is posted on the Promethean board (a type of interactive smart board) to guide their practice. They decide in what order they want to include each math element and begin breaking each element down into an eight-count movement. A student in Group 2 tells her group, "We need a line of symmetry." Another student adds, "We have to show different levels." The four group members subdivide the group into two pairs. One pair of students mirrors the other pair to show a line of symmetry. They take eight counts to move from this position to a polygon with eight sides using their arms. Then they move into their next position by having two members form an acute angle with their arms while the other two members form a circle around them with their arms. After the groups worked on their dances, they were given the opportunity to show the class their progress. Group 2 performs their dance first while the rest of the class sits on the perimeter of the rug to watch. One student begins the discussion with the first suggestion. He states, "They didn't have smooth transitions." The dance teacher replies, "Can you rephrase that as something more positive that they can work with?" The student rewords his initial statement, "You need to be more focused and have more concentration so you can have smoother transitions and have a good dance." The teacher nods in agreement. "One thing I noticed," another student says, "I didn't see a repeated phrase." Another student remarks, "Maybe you should try not to say what you were doing to see if we could figure it out. They would have to be more clear with their bodies if they didn't say it. That would make the dance better."

The scene just described provides a view into a third-grade classroom where students are participating in an arts-integrated learning experience. Working collaboratively, the dance teacher and the classroom teachers developed an integrated learning experience. Students were assigned

You are in a professional dance company called "Geometry in Motion" hired by your school to create a performance for students in the K–2 grades. Your school wants the company to perform a dance where groups work together. They also want the dance to include:

| Math components | Points earned |
|---|---|
| Right angle | /8 |
| Acute angle | /8 |
| Obtuse angle | /8 |
| Triangle | /8 |
| Square | /8 |
| Closed figure with more than 4 sides | /8 |
| Line of symmetry | /8 |
| **Dance components** | **Points earned** |
| Dance phrase that has a beginning, middle, and end | /8 |
| Smooth transitions | /8 |
| Repeated phrase | /8 |
| Low, medium, and high levels | /8 |
| Maintain concentration and focus throughout performance | /12 |
| Total math and dance components score | /100 |

**FIGURE 1** **Geometry dance rubric.**

the task of creating a geometry dance where the Standards for Learning and Teaching Dance in the Arts (National Dance Education Organization 2005) and the Principles and Standards for School Mathematics (National Council of Teachers of Mathematics 2000) were incorporated and assessed. Students worked in cooperative groups to create and practice their geometry dances using a teacher-created rubric (see Figure 1) as a guideline for including essential geometric and dance elements. The dance teacher in cooperation with the classroom teachers assessed the students' geometry dance performances using the rubric that included components from both geometry standards and dance standards.

## ARTS INTEGRATION

The term *arts integration* carries many different connotations in the field of education, each of which presents varying issues over the usefulness and effectiveness of arts integration in general education classrooms. Educators' perceptions of arts integration greatly influence the level at which integration takes place. Common terms in the field today include coequal integration, subservient integration, affective integration, and social integration (Bresler 1995). Others embrace terminology such as arts-based, arts-infused, and arts-included, among many others (Gullatt 2008). Aprill (2010) proposes that a rigorous definition of arts integration should be constructed, and arts instruction should be viewed as a piece of the whole culture of a school or program in which an array of professionals contributes to the plan. Aprill (2010) includes The Chicago Arts Partnerships in Education (CAPE) definition of arts integration: "Arts Integration is teaching and learning in which arts learning and other academic learning are connected in ways in which the arts learning and the other academic learning are both deepened" (7). The integrated learning experience between dance and geometry described in this article represents an example of what Bresler (1995) defines as coequal integration in which student learning is centered on higher-order cognitive skills and aesthetic qualities and poses higher-order questions of analysis, synthesis, and evaluation, which is consistent with the definition provided by CAPE.

Successful arts-integrated learning experiences can be achieved by establishing an interconnectedness between the arts and other content areas through close collaboration between arts specialists and the teachers of other academic subjects. Integrating the arts allows for multiple perspectives and provides a safe atmosphere for risk taking as well as a pleasurable learning experience for students (Lynch 2007). Integrating the arts also highlights how the elementary classroom curriculum and the arts naturally complement one another.

## LEARNING ACTIVITY DESCRIPTION

On the first day of a four-week unit on geometry, the teacher introduced the learning activity by presenting students with a task to create a geometry dance incorporating specified geometric concepts into a dance while including essential dance artistic concepts and skills. Students were divided into groups of four to six and instructed to plan their geometry dances incorporating all necessary elements, as outlined

by a rubric (see Figure 1). The elements included in the rubric represented the Principles and Standards for School Mathematics (National Council of Teachers of Mathematics 2000) and the Standards for Learning and Teaching Dance in the Arts (National Dance Education Organization 2005). Each day, the lesson introduced or reviewed a different geometric concept based on the mathematics standards and the dance education standards. Mathematics standard concepts addressed were the following:

- Identifying objects as circles, squares, triangles, or rectangles.
- Classifying lines and line segments, angles, and triangles.
- Exemplifying points, lines, line segments, rays, and angles.
- Classifying polygons according to the number of sides.

Dance standard concepts included the following:

- Demonstrating a dance phrase that has a beginning, middle, and end.
- Including smooth transitions, including a repeated phrase.
- Representing low, medium, and high levels.
- Maintaining concentration and focus throughout the performance.

Each of these standards was also integrated into the daily lessons by having students use their bodies and movement to demonstrate geometric concepts. For example, as students studied acute, obtuse, and right angles, they were instructed to explore ways they could use their bodies to form these angles. For example, students used their arms to explore how to illustrate acute, obtuse, and right angles, and they used their legs to illustrate scalene, isosceles, and right triangles. Students also demonstrated their understanding of triangles and polygons, form rays, line segments, and lines by using their body shapes and movements to explore geometric concepts. Explicit instruction in movement was integrated within the math lesson to expand students' understanding of dance concepts as well as deepen their understanding of the geometric concepts. Students were given approximately 15 minutes at the end of the daily math lesson to plan, practice, and refine their dances. Through this process, students were able to review the mathematical concepts using dance. This provided repetition for students who needed repeated exposure to master the concepts.

After planning and rehearsing their dances, one or two groups performed for the class to show their progress and receive feedback from their peers. The students critiqued the performance of others daily in terms of accuracy of geometric concepts as well as the required dance components. These performances held students accountable for progress in their group and provided frequent feedback to prompt student reflection. In addition, this allowed students the opportunity to critique the performance of others, engage in discussion about the cognitive and kinesthetic aspects of their performances, and provide constructive critiques that would further guide the development of the dances. Students informally discussed what they viewed and offered suggestions or positive comments for the group that performed. For example, after watching a group that did not maintain focus throughout their performance, one student stated, "Your giggling was distracting. You need more focus. And you stopped in parts and it didn't look like you had it memorized." Another student agreed, "Yeah, work on focus and memorizing it." Yet another student commented, "Why don't you try holding each shape for eight counts so we can clearly see what you are making with your bodies?" An example of positive feedback given to the performing group included a student who stated, "I really liked when they were chanting 'Geometry' and slowly stood up." Another student stated, "I liked the square at the beginning," to which a member of the performing group replied, "It was supposed to be a triangle." A student responded, "That wasn't very clear, maybe you should work on that."

## ASSESSMENT PROCESS

Assessment of the dance activity took place at different points throughout the learning experience and at various levels. Self-assessment, assessment by peers, and assessment by the teacher all took place informally. First, students were provided with a rubric (see Figure 1) during the planning stages of their geometry dances so they could assess whether they were meeting the criteria as they worked cooperatively with their groups to plan their performances. This rubric was displayed on the Promethean board each day. Students could assess themselves using the rubric to determine progress made and components that still needed to be addressed. Students earned a maximum of eight points for each component that was clearly evident in the dance. Partial points were awarded for components that were somewhat evident, and no points were given for components that were absent from the dance. For example, a score of 5 was awarded for the dance component, high, medium, and low levels, when only two of the levels were represented by the group members, as opposed to a score of 8 when all three levels were evident. A score of 2 was awarded when there was only one level represented, and a score of 0 was awarded when there was no evidence of attempting different levels. When the dance and geometry project was introduced by the teachers, the students were given an example of the criteria for full credit, partial credit, and no credit for each component. The performance component was weighted (with 12 points) more heavily because the students completed other geometry tasks throughout the unit, but this was the only performance task. The dance teacher and third-grade teachers worked collaboratively to orient themselves in both the dance education and math curriculum standards by searching for a meaningful and natural connection between the two subject areas. They viewed this connection as an appropriate approach to equal learning in the cognitive and kinesthetic domains. Through dance shapes and movements, students demonstrated their knowledge and

understanding. Each component directly correlated with a third-grade math or dance standard. In third grade the dance education standards address repeated phrases. Students created a dance phrase that they had to incorporate and repeat. In math, students must recognize a line of symmetry, and they used their bodies to create a line of symmetry in their dance.

Daily performances, conducted after students worked on their dances, represented a second phase of assessment that provided an opportunity for groups to receive feedback from their peers on ways to improve either the communication of key geometric concepts or the aesthetic components of the dance. This phase of assessment proved to be essential as students refined their dances in an effort to communicate geometric concepts more effectively while utilizing the dance components in an aesthetically pleasing manner. This was done in an effort to communicate their geometry dances to an audience as works of art and a demonstration of mastery of geometric and dance components. This reflection time and feedback allowed students to become critics of the efforts of others as well as themselves. Aligned with the Principles and Standards for School Mathematics (National Council of Teachers of Mathematics 2000) process standards (problem solving, reasoning and proof, communication, connections, and representation), this experience provided students with the opportunity to build connections within and between content areas while increasing communication, discourse, and the ability to make conjectures about mathematical concepts related to their work with their group members.

The third phase included a formal assessment of the geometry dances by the teacher. Using the rubric (see Figure 1), the teacher assessed the students' overall performances including aspects from the cognitive and kinesthetic domains, evident in both the math and dance components. As the groups performed their dances, the teacher determined if each component was clearly evident (8 points), somewhat evident (2–7 points), or not evident (0–1 points) and assigned point values accordingly.

## STUDENT AND TEACHER REFLECTIONS

At the culmination of the unit, students provided written reflections on the learning experience noting how integrating dance and geometry contributed to their understanding. Students were asked to respond to the following questions: What did you learn about geometry in this unit? Did using dance help you in your understanding of geometry? If so, in what way(s)? The following written reflections were provided by students:

> I learned that there is more than just simply shapes like a square or circle, and I learned how to form more shapes inside others to make another shape. Yes, it did help me because not only did these things help; it was fun, which made it more interesting to learn about. Like our geometry dances. They helped me and they were fun.

> That geometry isn't all about shapes, it's also about angles and lines, line segments, and rays. I also learned that you may not notice it, but shapes are all around you. For dance, I learned that doing a geometry dance not only requires you working hard and learning shapes, it teaches you how to cooperate with others.

> In geometry we learned about how circles have a radius, diameter, and the center. I also learned different kinds of lines. If you were a builder you would need to know this stuff. Our geometry dances helped me learn more about how right, acute and obtuse angles worked. It also helped me learn that you can make shapes with your body.

In these representative reflections, students communicated math content learned as well as how dance informed their understanding of geometric concepts. Students reported appreciating a "fun" approach to learning geometry through dance and enjoyed cooperating with others. Students also mentioned that using their bodies to form shapes and angles helped them understand how they "worked," signaling a deeper understanding of the geometric content addressed than could be achieved by more traditional teaching methods. Other students benefited from the repetition involved in practicing and performing the dances because the daily experiences reinforced exposure to concepts resulting in mastery of both dance and math concepts.

The classroom teacher also reflected on the geometry dance as an integrated learning experience. The following written reflection was provided by one of the third-grade teachers after observing a session in which students were working in groups on their dances:

> I can assess the students' understanding of the math elements required as I observe them practicing their dances. Next time, I will have each group share what they think they did well in their dances and what they feel they should improve. This prompts a level of self-reflection that was not evident in today's lesson. We could possibly even check out the flip cameras from the library and record each performance and have the students view it and critique themselves before they formally present their dance to the class. It was encouraging to see students refining their understandings of the math concepts required in the dance. Overhearing a couple discussions, I realized that the students are essentially scaffolding each other to bring their poses to a level that is accurate and acceptable by the standards of everyone in the group. I don't think you get this type of interaction among peers when students are involved in more traditional, paper–pencil instruction and assessment.

In this reflection, the classroom teacher acknowledges the importance of self-reflection and how it contributes to the learning process. She sees the value of including self-reflection and suggests future opportunities to use it in her classroom. The teacher also begins to value the increased communication and discourse between and among students as they collaborate on their dances. She notes that students share ideas, question each other, and seek variations and changes when working on a group project such as the geometry dance.

## IMPLICATIONS FOR LEARNING

This learning activity presents important implications for K–12 teachers. First, the collaborative effort that took place between the dance specialist and the classroom teacher contributed to the overall effectiveness of the activity, suggesting the importance of this type of collaboration in schools. Often, classroom teachers do not have a strong background that integrates the kinesthetic domain into their subject area lessons. Forging collaborative relationships with the dance specialist can help to eliminate the dichotomous relationship between the general education classroom content and arts education content, thereby generating meaningfully integrated learning schoolwide (Aprill 2010).

Creating a meaningful connection between domains is another implication of this unit and arts integration in general. According to the information processing theory of learning, encoding is usually accomplished by making new information meaningful and integrating it with existing information in long-term memory (Schunk 2008). The coequal integration of geometry concepts and dance concepts makes both meaningful, thereby enhancing learning in both domains (Bresler 1995). Some arts proponents are opposed to arts integration, as they believe in teaching art solely for the sake of education in the art form. This is a view dependent on keeping the arts pure and disconnected from other subject areas (Brandt 1987). However, the arts are inherently connected to other domains of knowledge and therefore are disconnected at the expense of the intimacy between the arts and other domains. Serious arts integration efforts result in a focus on this intimacy and yield artwork that is conceptually compelling and aesthetically sophisticated (Aprill 2010). Rigorous arts-integrated approaches, as exemplified by the learning experience presented in this article, deepen understanding in the art form as well as other academic areas.

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