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DANCING: A Strategy to Maintain Schoolchildren's Openness for Idea Generation

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Schools are the institutions that rather recently took over the role of teaching children how to acquire the skills and knowledge they need to become independent individuals (Gleitman et al., 2011; Gopnik, 2016). A learning process should also include interventions to challenge children's innate capacity for openness, explorative thinking, and mental simulation forward in time (Diamond & Lee, 2011; Fenker & Schütze, 2009; Lerner & Tetlock, 2003; Szpunar et al., 2014). Nevertheless, scholars point to the fact that school curricula do not have strategies to support such mental activities (Castillo-Vergara et al., 2018; Guilford, 1950; Senge, 1990; Wahlgren, 2011).

Humans' innate capacity for openness and mental simulation provides a platform for the mind to potentially combine or meld abstractions into cognitively distinct categories; that is, idea generation (Finke, 1996; Österberg, 2012; Pringle, 2016; Turner, 2014; Wynn et al., 2009). This cognitive flexibility reveals itself at an early age as a subset to the executive functions (Coolidge & Wynn, 2018; Diamond, 2013; Welsh & Pennington, 1988). However, before children are 5 to 7 years of age, an obstacle for cognitive flexibility emerges as children suffer from functional fixedness, the cognitive bias preventing divergent thinking (Chrysikou et al., 2016; Duncker, 1945; German & Defeyter, 2000).

Support of executive functions should include programs that enable children to suppress functional fixedness; that is, to facilitate openness to experience in an intellectual way. Diamond and Lee (2011) concluded that there are a number of diverse activities that can facilitate idea generation, including music and body movement. However, the authors excluded the combination of rhythmic body movement to music; that is, dancing. Alternatively, as Sir Ken Robinson famously said, "Why not [dance]?" (Robinson, 2006, 08:52).

Rhythmic body movement to music, or dancing, has an evolutionary foundation (Dunbar, 2012). Dancing influences human emotions and cognitive flexibility, including idea generation (Lewis & Lovatt, 2013; Lovatt, 2013). Fink and Woschnjak (2011) showed that among adult male and female professional dancers, improvised dancing influenced verbal and figural creativity to a greater extent than choreographed dancing. Several questions emerge: Would the same apply for primary schoolchildren? What kind of music is appropriate?

Studies of students listening to different kinds of music found that music in a major key was associated with feelings of joy and music in a minor key was associated with feelings of sadness (Hunter et al., 2010; Trochidis & Bigand, 2013). An interesting finding for our study was the association of high tempo with increased arousal and slow tempo with tranquility. In addition, Foster (2018) maintains that music is a form of communication that helps children recognize and embrace their feelings.

The physical nature of music is complex vibrations, densifications, and thinnings in the air, which puts the eardrum (tympanic membrane) into complex but regular movements (Dowling & Harwood, 1986). An important aspect is that these physical vibrations can be sensed by tactile organs as well as hearing organs (Levänen & Hamdorf, 2001; Tranchant et al., 2017). Here we focus on repetitive patterns in music that can be perceived as rhythmization relative to a pulse (Pouthas, 1996). Thompson (2017) discussed what makes music catchy and argued that interruptions from repetitive patterns arouse the listener's interest. When experiencing music, the listener can recognize an emotion depending on the style of listening (Meyer, 1956); that is, in what way she or he is involved in the music. The emotional state can change (or be adjusted) so that the listener experiences what the music expresses (Gabrielsson & Juslin, 1996; Hargreaves & North, 1997). The listener may also act (react) as a response to, and in interaction with, the music (McFerran & Saarikallio, 2014). Thus, the listener's need to move the body in certain ways can be considered a response to the emotional expression of music (Côté, 2006).

The importance of rhythm for human development, both socially and linguistically, should not be underestimated (Bannan, 2017). Moving together and responding to rhythmic sounds can enhance aspects of learning and stimulate cognitive flexibility. Moving together and responding to rhythmic sounds can enhance aspects of cognitive development and stimulate creativity. Byrge and Tang (2015) applied long-term embodied creativity training that influenced students' creative self-efficacy and provided an increased awareness and confidence in their own creative abilities. Furthermore, their study indicated a spillover effect from the exercise activities into the rest of the school day. In addition, Castillo-Vergara et al. (2018) found that activities stimulating creativity increased the performance of students, and they argued that these kinds of activities should be considered an imperative for all education. Robinson and Aronica (2015) also presented findings from school systems where teachers integrate creativity into students' daily experience of the learning process to foster self-organized learners. However, there is a lack of knowledge on how to facilitate cognitive flexibility in a learning situation, which educational policymakers need to take seriously (Ucus & Acar, 2019).

In conclusion, idea generation, an aspect of cognitive flexibility, will not ignite unless a person is in a proper motivational and emotional state to facilitate openness to experience. Dancing to music at high tempo appears to establish this kind of motivational and emotional state of mind. Schools by tradition exclude such aesthetic manifestations from their curricula; therefore, this potential for improvement needs to be explored. The purpose of this study was to test whether a brief moment of dancing to music at high tempo will influence humans' inborn ability to meld these abstractions into cognitively distinct categories.

Method

Participants. Fifty-one primary schoolchildren (25 girls), age 12, took part in an experiment described as a break from their daily schoolwork. Originally an invitation was sent to 55 pupils and their parents and 4 chose not to take part.

Procedure. An agreement was made with the head (rector) of a school in the middle of Sweden. Permission was requested from the parents of the children participating in the study. The children were informed in advance that a test was to be carried out, but the content was not revealed prior to the beginning of the test.

One of us went to the school and met with the teacher. We then jointly went to meet the first class. After entering the classroom, a brief presentation of the test was made. The children were then asked to dance for 3 min before sitting down ($n = 25$). The other class ($n = 26$), which served as the control group, did not dance but

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performed the test right away. The study used a paper-and-pencil test. A paper containing the instructions was put on the desks upside down. At a given signal, all children were asked to turn the paper over and follow the instructions: *combine the two shapes/letters to form as many meaningful objects as possible. If you do not understand what to do or are unsure, you can make your own interpretation or take chances* (time frame: 5 min).

Dance Intervention (Choice of Music). Based on its popularity and message, the song chosen for this study was "You Should Be Dancing" by the Bee Gees. The tempo is steady, at approximately 120 bpm; the harmony is simple; and nothing unexpected happens until a short guitar solo comes in. The drums and the harmony continue unchanged throughout the song. Finally, the male vocal in falsetto is characteristic of the genre and the message of the lyrics is explicit: Dancing is good!

J&D Idea Generation Test. Humans' ability to meld abstractions into cognitively distinct categories can be assessed using existing symbolic representations, like letters. Finke et al. (1989) used the letters J and D to assess imagery of expected meaningful concepts, for example, an umbrella (J and D, rotated 90 degrees to the left). Based on Hocevar (1979), who concluded that idea frequency is a key factor for idea generation, we assigned respondents to produce as many combination as possible. In addition, Dauch et al. (2018) showed that, among young children, less is more when using a number of items for idea generation.

The purpose of the J&D tool is to enable measurement of idea generation in a relatively simple manner. The design of this tool aims to minimize the problems associated with self-reporting, a problem that most well-known measurements do not take into consideration satisfactorily (Silvia et al., 2012).

Data Analysis. The responses were analyzed using principles for a consensual assessment technique (Amabile, 1982) framed by three dimensions for idea generation (Beghetto & Kaufman, 2009):

- *Frequency.* The frequency is a measure of the total number of objects constructed. By counting the number of attempts, the frequency is thus a measure of productivity. However, it is not sufficient in itself to assess whether this productivity can be classified as creative. The analysis also needs to assess how the subject has understood the graphical figures.
- *Combination.* Combination is the degree to which both figures are combined to create meaningful objects. If the subject combines the two figures so that they form any kind of object, by rotating the figures etc., then they are considered original and meaningful combinations. A fourth category of attempts includes those that are incomplete or unreadable; that is, meaningless combinations.
- *Originality.* Originality is identified as the use of the figures other than as letters. If the subject combines the figures to form abbreviations, initials, or whole words (i.e., adding other letters), then they are considered to be letters. The consequences are described in the Results and Discussion section.

The J&D index is an aggregation of frequency, originality, and combination representing subjects' level of creative productivity

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by idea generation. To clarify how this assessment has been carried out, a few typical examples are presented: One subject that only combines letters can never receive a J&D index value of 9 (highest value) no matter how many letters are produced. However, this subject will still receive a higher assessment than someone who only created one or two meaningful objects. Another subject who only combined graphical figures and, for example, created 15 meaningful objects would be assessed at an 8 or 9 on the J&D index. However, the subject who creates, for example, seven meaningful objects but also five words (i.e., using letters) would receive a lower aggregated assessment on the J&D index scale. Analysis of variance was applied.

Results and Discussion

The aim of the study was to test whether a brief moment of dancing could suppress functional fixedness and enhance openness to experience among children who have attended school for some years. The result indicated that both boys' and girls' inborn cognitive flexibility, manifested in idea generation, was triggered in a similar way by the brief dance intervention (frequency: $F = 1.13$, $p = .29$; combination: $F = 0.78$, $p = .38$; originality: $F = 1.89$, $p = .18$; J&D index: $F = 0.31$, $p = .58$). For both male and female participants dancing influenced frequency ($F = 5.3$, $p = .026$) and combination ($F = 6.47$, $p = .01$), originality ($F = 0.43$, $p = .51$), and J&D index ($F = 4.35$, $p = .04$).

There are numerous studies demonstrating that dancing influences human emotions and cognitive flexibility, including idea generation (Fink & Woschnjak, 2011; Lewis & Lovatt, 2013; Lovatt, 2013). This study did not gather the data from a lab but rather used a classroom to assess a real-life learning situation. The use of exemplar and goal-oriented instructions was also avoided. It appears that giving people abstract instructions is another way to suppress functional fixedness (Chrysikou et al., 2016).

Dancing has evolutionary origins, and the application is cross-cultural (Bannan, 2017; Dunbar, 2012). This study argues that using brief moments of dancing in the classroom is an effective tool to facilitate openness and explorative thinking that may manifest in idea generation (J&D index). The results show a significant effect on frequency where those who danced for 3 min were more productive in generating ideas. Analogous to the "quantity breeds quality" principle of brainstorming, the meaningful combinations also increased among the group that danced. It is interesting that the dance intervention affected originality to a lesser extent than frequency and combination (not significant from a statistical point of view). This could be due to functional fixedness because the level of acquired reading ability may have prevented the students from interpreting the letters as graphic figures that can be rotated and combined into meaningful objects other than words.

Life is not a straight line, and the future can only be imagined in a prospective manner (Gilbert & Wilson, 2007; Schacter & Addis, 2007; Szpunar et al., 2014). It is important that children sustain flexibility and facilitate an intellectual openness to experience so

that they can successfully devise solutions never considered before (Diamond & Lee, 2011; Oleynick et al., 2017). Therefore, the results of the current study indicate that dance activities should be included in the curriculum as an intervention to maintain schoolchildren's cognitive flexibility.

Future research. This study used a new approach to assess idea generation that was called the J&D test (Österberg, 2012; Österberg & Köping Olsson, 2018). Although its antecedents are validated (Finke et al., 1989; Hocevar, 1979), there may be issues with validation. Therefore, the J&D test used in this study should be further validated with other widely used and reliable instruments for measuring idea generation.

Furthermore, in a previous study the authors used a perspective of semiotics in music psychology describing how the various components of the music can affect the listener's emotional state (Österberg & Köping Olsson, 2018). The song selected for this study consisted of the following elements. Firstly, the steady, prominent, and repetitive drums, played at a relatively high tempo (approximately 120 bpm), minimize the listener's possible hesitation about the pulse and which beats are strong or weak, regardless of whether the listener deliberately analyzes this. Secondly, the harmony is very simple because the whole song is composed of two chords (G minor and C minor with a very short A minor in a bridge). The bass and keyboards reinforce the repetitive and harmoniously stagnant music because no progression comes to expression — nothing unexpected happens. There is an interruption (in a bridge) with a guitar solo, though the drums and the harmony continue unchanged and a horn section plays short staccato tones over unchanged harmony. Thirdly, the male vocal in falsetto is very distinctive and has had a long-standing impact on singing in this genre. This also relates to the index factor mentioned above. The message of the lyrics is explicit: Dancing is good!

To investigate how the intervention's design affected the results of this study, it is suggested that each of the influencing factors mentioned above could be altered in new studies. One such parameter is the tempo; to what extent the tempo — that is, the intensity of the activity — affects the creative abilities and productivity of the subjects should be investigated. What effect would movement to J. S. Bach's "Air" have? According to music semiotics, the subject's experience of the music's characteristics is influenced by the tempo as well as the tonality and harmony. What effect would a popular children's song in a major key or a melancholic country song have?

Finally, it is also suggested that future studies should investigate whether and how the subjects' music preferences affect the effect of the intervention. Regardless of the limited scope of this study, the results provide additional arguments for the inclusion of brief moments of dancing in classrooms to enhance programs that support children's development both socially and cognitively.

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