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The Biopsychosocial Model and Salivary Metabolites in Modern Dancers

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Our objective was to establish relationships among concentrations of salivary metabolites (glucose, lactate, non-esterified fatty acid, cortisol, heat shock protein 70), acute and chronic fitness markers, and dancers' perceptions of a modern dance class. Dancers (N = 12) completed six salivary samples on three dates: day 9, 51, and 93 of the semester, before and after a sixty-minute modern dance class. Additionally, dancers were asked to report their mental stress, physical fitness, health, class stress, and how many minutes they believe they spent working at a low, moderate, or high energy level. Largest concentrations of salivary cortisol and lactate were noted in females before class and were different ($p < 0.02$) from concentrations in females after class. In addition, cortisol concentrations decreased ($p < 0.001$) over the semester (1988, 1920, 1214 ± 259 pg/mL; respectively, day 9, 51, and 93). An interaction ($p < 0.05$) between time and gender affected fitness scores, as female fitness scores increased from day 9 to 51 and 51 to 93 while male fitness scores decreased over the course of the experiment. Body mass index (BMI) was positively correlated ($r > 0.34$; $p < 0.05$) with fitness and health scores and negatively correlated ($r = -0.53$; $p < 0.01$) with class stress. Our results serve as building blocks for a heightened understanding of the body's experience during modern dance classes, and advocate for a biopsychosocial approach to analyzing dance as a source of stress relief and fitness.

Key words: modern dance; salivary metabolites; dance physiology; biopsycosocial model; physiology

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Introduction

Over the past few decades, exercise has become a more common outlet for people seeking fitness training and stress relief (Jackson, 2013). As interest in exercise increased so did interest in the potential benefits of movement and dance classes (Murica et al., 2010). However, there continues to be a gap in knowledge between the field of exercise physiology and the art of dance. We hypothesize that gap limits the amount of information available to holistically consider dance as both a recreational exercise outlet and a source of therapy in hospitals and clinics. This study strives to bridge that gap by examining the physiological indicators of acute/chronic fitness and stress as one experiences modern dance exercise.

In addition, we pursued a biopsychosocial approach, first proposed by George Engel, to better capture the full experience of a dancer (Engel, 1977). When dancers are asked to perform physically demanding and technically precise exercises, they are simultaneously asked to make aesthetic choices, adopt artistic qualities, and interact with fellow dancers. Dancers, therefore, must constantly work at the intersection of the physical body, psychological analysis of the audience's perceptions, and the social environment created. Those multifaceted requirements are what separates dance from other exercise forms, thus necessitating the biopsychosocial model.

A dancer's biological experience can be captured through non-invasive salivary samples, which facilitates the study of metabolites without the additional stress of the collection method (Saeediborujeni et al., 2018). The salivary metabolites evaluated in this study are related to either the human body's stress response or metabolic pathways, both of which are significant in response to exercise. Cortisol is a classic stress response molecule that is a lipid-soluble, steroid hormone (glucocorticoid) that traverses the cell membrane and binds to the nuclear receptor (Farrell, 1983). However, cortisol cannot initiate the genomic-cellular response to stress without heat shock proteins. The complex formed between cortisol, its nuclear receptor, and the heat shock proteins form a transcription factor that regulates gene expression (Noble and Shen, 2012). This complex is the link between external stressors and the body's response to stress, including exercise (Heaney et al., 2013).

Glucose is the body's main source of energy and is processed through glycolysis followed by the citric acid cycle if aerobic conditions are present. Under anaerobic conditions, the product of glycolysis, pyruvate, can be converted into lactic acid and shuttled into the Cori Cycle, which leads to glucose production in the liver, which can be utilized by the working muscles or brain (Facey, 1986; Shalin, 1986). Therefore, glucose and its breakdown product (lactate under anaerobic condition) can be indicative of an individual's fitness or metabolic environment (Jensen and Richter, 2012). Non-esterified fatty acids (NEFA), transported by forming complexes with protein, can fuel the body's activities during longer periods of aerobic conditions or starvation periods (Franks et al., 2002; Kulkarni

et al., 2012; Wade et al., 2015). By analyzing glucose, lactic acid, and NEFA concentrations, one may determine if the dancer's muscles are mainly functioning under anaerobic or aerobic conditions.

Overall, our long-term objective is to develop physiological indicators that lead to a greater understanding of the biology related to longitudinal fitness training in dance. Specific aims for this research were to determine: A) the concentration of salivary metabolites before and after a dance class (specifically cortisol, heat shock protein 70, glucose, lactate, and non-esterified fatty acids), with consideration of gender and a self-reported fitness level, B) the effects of acute and chronic conditioning over fourteen weeks on the salivary concentrations of metabolites, and C) whether dancers' self-reflections, rankings, and answers to survey questions are reflected in their salivary biomarker concentrations.

Materials and Methods

Dancers (N = 12) enrolled in a University of Arkansas, Little Rock (IRB #: 17-056) modern dance class completed six salivary samples on three dates: day 9, 51, and 93 of the semester (weeks 2, 8, and 14). Samples were taken before and after a sixty-minute modern dance class, and a supplemental demographic and self-reflection survey (Appendix Table 1) was completed. Dancers were asked to self-report their mental stress, physical fitness, health, class stress, and how many minutes they believed they spent working at a low, moderate, or high energy levels. "Health" was differentiated from "fitness" using the following statement: "Please note that illnesses, injuries, infections, etc. are included in the "health" category."

Self-reported class stress, mental stress, physical fitness, and health scores were calculated as percentages in reference to 0% being the worst (ex. health) or lowest (ex. mental stress) possible and 100% being perfect (ex. health) or highest (ex. mental stress). Investigators created class maps detailing the design, progression, and observed intensity of the exercises within the sixty-minute period. On each date, weight (kg) and height (cm) were recorded and body mass index (BMI) was calculated [weight (kg) / height (m^2)]. The class structures were recorded and can be found in Appendix Tables 2, 3, and 4, respectively day 9, 53, 91. Briefly, for each activity recorded, a researcher estimated the dancers' energy levels based on the following credentials: Sedentary – majority of the time spent standing, sitting, or lying with only minimal movement, Low – minimal, intentional dance movement or movement demonstrated with little additional effort, Moderate – intentional movement where dancers were required to exert a significant effort, though not their maximum effort, High – intentional movement where dancers worked at or near their maximum effort, noted by heavy breathing, visible exhaustion, and other verbal/physical cues.

Biological experience of the dancers was captured via salivary metabolite analyses. Within 10 minutes before and after each of the three class periods, dancers were asked to rinse their mouths with water and produce approximately 3 to 5 mL of saliva into a sterile, plain, glass tube (Vacutainer, Becton-Dickinson, Rutherford, NJ). Samples were immediately placed in ice and stored at -20°C. Upon collection of the last set of samples, all samples were quick thawed in water (40°C) and centrifuged at 1500xg for 30 minutes at 5°C. Supernatant was decanted and stored at -20°C until assayed.

Metabolite Analysis

All metabolites were analyzed using commercial kits and followed manufacturer's protocol. Validated ELISA kits were utilized to determine concentrations of cortisol (Cayman Chemical, #500360; read at 410 nm) and heat shock protein 70 (Enzo, #ADI-EKS-715; read at 450 nm). Colorimetric assays were utilized to analyze the concentrations of glucose (Cayman Chemical, #10009582; read at 510 nm) and NEFA (Bioo Scientific, #5620-01; read at 550 nm). Concentrations of L-Lactate were analyzed using a fluorometric assay (Cayman Chemical, #700510; read at excitation: 530/25, emission: 590/35).

Statistics

Data were analyzed using analysis of variance. When main effects (gender, sample date [day 9, 51, and 93], sample time [before and after exercise within a sample date]) and main effect interactions had significant F-tests, means were separated using multiple t-tests. Pearson correlations were calculated to determine associations between and within survey responses, metabolites, and dancer physical traits (weight and BMI).

Results

Survey

Demographic data can be found in Table 1. Gender was not a significant ($p > 0.06$) source of variation for demographic data and survey results. Mental stress scores, recorded before the class, had a positive relationship ($r > 0.40$) with class stress scores, recorded after class ($p < 0.05$ on day 9 and 51, and $p = 0.07$ on day 93).

Table 1. *Demographic Means by Gender*

Item	Female	Male	Minimum	Maximum
N	8	4	-	-
Weight (kg)	65.6	74.7	44.8	84
Height (cm)	163.3	175.3	152.4	181.6
BMI	24.6	24.4	18	33.9
Self-reported[1]				
Fitness (%)	61.2	64.5	31.7	92.9
Health (%)	64.4	74.3	30.4	99
Mental Stress (%)	49.1	52.7	2.1	92.9
Low Energy (mins.)	12.9	12.2	2	35
Med. Energy (mins.)	24.9	24.2	5	53.4
High Energy (mins.)	22.2	23.6	0	43
Class Stress (%)	35.4	37.3	4	83.8

[1]Self-reported values come from the survey data

Dancer BMI had a negative relationship ($r = -0.53$) with class stress scores [day 9 ($p < 0.05$) and day 51 and 93 ($p < 0.07$)]. An interaction ($p < 0.05$) between time and gender affected perceived fitness scores. Female fitness scores increased from day 9 to 51 and 51 to 93 while male fitness scores decreased over the course of the experiment. Female fitness scores also were different ($p < 0.01$) from day 9 to day 93.

Weight and health scores were positively correlated ($r > 0.37$; $p < 0.05$) with fitness scores. Fitness scores were positively correlated ($r = 0.37$; $p < 0.05$) with health scores. Weight and perceived fitness and health scores were all negatively correlated ($r < -0.41$; $p < 0.05$) with class stress scores. Class stress scores were positively correlated ($r = 0.40$; $p < 0.05$) with mental stress. Counter intuitively, BMI was positively correlated ($r > 0.34$; $p < 0.05$) with fitness and health scores while being negatively correlated ($r = -0.53$; $p < 0.01$) with class stress scores.

Metabolites

Interactions between gender and time on metabolite concentrations are presented in Table 2. Largest concentrations of cortisol were noted in females before class and were different ($p < 0.001$) from cortisol concentrations in females after class. Cortisol concentrations of males both before and after class were intermediate to those in females. Cortisol concentrations decreased ($p < 0.001$) over the semester (1988, 1920, 1214 ± 259 pg/mL; respectively, day 9, 51, and 93).

Table 2. *Interactive Effects of Gender and Time on Salivary Metabolites*

Metabolite	Female		Male		SEM	P =
	Before Class	After Class	Before Class	After Class		
Cortisol (pg/mL)	2334[a]	1033[b]	1856[ab]	1607[ab]	344	0.006
HSP-70 (pg/mL)	312	245	383	340	155	0.91
Glucose (ng/mL)	3160	840	1810	3960	3520	0.56
NEFA (μM)	31	60	63	34	18	0.12
Lactate (μM)	663[a]	296[b]	398[ab]	577[ab]	179	0.02

[ab] means without a common superscript differ ($p < 0.05$)

Lactate was affected ($p < 0.02$) by an interaction between gender and time. Similar to cortisol, largest concentrations of lactate were found in females before class and differed ($p < 0.01$) from females after class. While it was not significant, salivary lactate concentrations increased from before to after class in males. Salivary concentrations of glucose, NEFA, and HSP-70 were not affected ($p > 0.2$) by time, date, gender, or their interactions (Table 2). Cortisol and NEFA concentrations were not correlated ($p > 0.25$) with the other metabolite concentrations. Concentrations of HSP-70 were correlated ($r > 0.46$; $p < 0.01$) with lactate and glucose concentrations. Lactate concentrations were correlated ($r = 0.54$; $p < 0.001$) with concentrations of glucose.

Survey and Metabolites

Relationships between survey responses and metabolite concentrations were determined using Pearson correlations (Table 3). Salivary concentrations of HSP-70, glucose, and lactate varied in their relationships to survey responses but were not ($p > 0.1$) correlated. Cortisol concentrations were negatively correlated ($r < -0.38$; $p < 0.05$) with BMI and weight; conversely, cortisol concentrations were positively correlated ($r = 0.47$; $p < 0.01$) with class stress scores. Concentrations of NEFA were negatively correlated ($r = -0.46$; $p < 0.01$) with health scores and positively correlated ($r = 0.38$; $p < 0.05$) with class stress scores.

Table 3. *Pearson Correlation Coefficients Between Survey Responses and Salivary Metabolites*

		Metabolite				
		Cortisol (pg/mL)	HSP-70 (pg/mL)	Glucose (ng/mL)	NEFA (μM)	Lactate (μM)
Survey Item	Means	1700	309	2839	165	491
Weight (kg)	68.7	-0.38*	-0.10	-0.17	-0.25	-0.01
BMI	24.5	-0.50*	-0.27	-0.18	-0.31	-0.09
Self-reported						
Health (%)	62.4	-0.24	-0.16	-0.11	-0.46**	-0.18
Fitness (%)	67.8	-0.20	-0.13	-0.12	-0.23	-0.01
Mental Stress (%)	50.4	0.12	-0.02	-0.06	0.04	0.03
Low Energy (mins.)	12.7	0.16	0.13	-0.18	-0.18	0.04
Medium Energy (mins.)	24.7	0.02	0.03	0.07	-0.06	-0.11
High Energy (mins.)	22.7	-0.13	-0.12	0.06	0.18	0.09
Class Stress (%)	36	0.47**	0.03	0.06	0.38*	-0.06

[1]Self-reported values come from the survey data; $^{*}p < 0.05$, $^{**}p < 0.01$

Discussion

Common stereotypes suggest that dancers have an enhanced understanding and awareness in regard to their bodies, yet our results suggest that the effects of mental and body perceptions in dancers cannot be so easily predicted. Some of our most interesting findings suggest consistencies and inconsistencies in the mind-body relationship of dancers. Dancers exhibited mind-body awareness when ranking class stress relative to cortisol levels, resulting in a positive correlation between the two. Our participants also ranked the class as less stressful if they ranked themselves as healthier. Additionally, if dancers were mentally stressed before, they considered class as more stressful. Those results offer valuable insight into the effects of mental perceptions on class perception and possibly performance.

Evidence of a mind-body disconnect was found in regard to the associations between BMI and class stress, fitness, and health trends. As BMI increased, participants tended to rank the class less stressful than those with lower BMI scores. Those with higher BMI scores also tended to rank themselves as more healthy and more fit compared to those with lower scores. Correlations between higher BMI and lower class stress, higher fitness, and higher health scores pose many continuing questions. Those correlations could be due to the fact that the Body Mass Index (BMI) analysis model, while one of the most widely utilized body classification models, is not accurate in distinguishing

whether a larger body mass is composed of primarily fat or muscle. If BMI is inaccurately labeling highly muscular or fit individuals as overweight, this could, at least in part, explain the correlation with higher self-reported fitness and self-reported health scores.

Additionally, we must acknowledge the presence of eating disorders within the dance discipline. If these correlations were analyzed from the opposite perspective (i.e. that dancers closest to underweight classifications on BMI tended to rank the class more stressful and themselves less fit and less healthy), we must consider the psychological tendencies associated with those struggling with eating disorders. Two specific types of "perfectionism" have been found to be associated with eating disorders: 1) wanting to achieve high personal standards and 2) the degree of concern with self-criticism generated when standards are not met (Wade et al., 2015). Psychologically, those tendencies could lead underweight dancers to rank themselves as less fit, less healthy, and more stressed if they were found to be experiencing an eating disorder. However, since our study did not specifically examine the presence of eating disorders, dietary habits, or the accuracy of BMI, we cannot make conclusions with respect to these areas. We would advocate for a more rigorous assessment of those items in future studies.

Our research demonstrated a lack of clear evidence regarding the metabolic pathways utilized during the modern dance classes. In regard to metabolite concentrations, we predicted a clearer distinction in both time and date effects on glucose, NEFA, and lactate concentrations. The results did not indicate whether dancer's cellular metabolism was primarily anaerobic or aerobic. Although, in females, salivary lactate concentrations decreased from before to after class. Our strong significant correlation between concentrations of lactate and glucose hints to cellular anaerobic metabolism. The lack of elevated salivary NEFA concentrations after class suggests that modern dance may not lead to metabolic stress and fat mobilization for weight loss. If found to be true, persons looking to increase their fitness through weight loss would need to turn to an additional form of exercise. The positive correlation between NEFA concentrations and perceived class stress suggests that NEFA may serve as a biomarker for an individual's workout routine. Lastly, decreased cortisol concentrations from before to after class for females indicate that modern dance may serve as a stress release tool. That decrease in stress also has been seen in dance movement therapy (Jeong et al., 2005; Ritter and Graff, 1996).

Overall, it is important to note that the three modern dance classes were not identical to one another but rather followed the progression of a Modern II (intermediate level) dance course over a semester. The specifics of the different class structures can be found in Appendix Tables 2, 3, and 4. The "estimated energy level of the students" recorded in these tables were determined by a researcher who had taken classes with the instructor before and in real time utilized visual and physical cues to estimate the students' levels of exertion. We believe this information is valuable for current dance teachers and

professionals. However, for future research projects, a codified exertion scale, such as Borg RPE scale, might be utilized (Borg, 1982; Wyon et al., 2002). Combining our results with subsequent research, one could advocate for more specialized nutritional and cross-training guidelines for modern dancers.

Conclusion

Our results serve as building blocks for a biopsychosocial approach for analyzing dance as a source of stress relief and fitness. The disconnect between biological and psychological aspects of our study was crucial for understanding our observed class experiences. Further, research investigating metabolite concentrations with the aid of dancer self-reflections has the potential to build a more comprehensive or holistic picture of the modern dance class, which could impact professionals, patients, and dancers worldwide. Our study demonstrates that the dance experience is more than simply biological, psychological, or social, but rather an interesting intersection of all three disciplines.

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Addendum I: *Sample Survey*

Pre- Survey:

1. Name _____ Today's Date _____

2. Date of Birth _____

3. Gender _____

4. Race _____ (African American, Caucasian, Hispanic, etc.)

5. Height _____ Weight_____

6. Please mark your physical fitness on the line below:

Low Fitness Medium Perfect Physical Fitness

_____

7. Please mark your physical health on the line below:

(Please note that illnesses, injuries, infections, etc. are included in this category.)

Poor Health Medium Perfect Health

_____

8. Please mark your current mental stress level on the line below:

Low Mental Stress Medium High Mental Stress

_____

9. Did you eat breakfast? _____ Yes _____ No

If yes, what you have? _____

10. Do you smoke? ____Yes _____ No

If yes, how often? _____

Post Survey:

1. How many minutes were you in class? _____
2. How many minutes were you working at a low energy expenditure (resting heart rate)?
   _____
3. How many minutes were you working at a moderate energy expenditure (50-70% of max heart rate)?
   _____
4. How many minutes were you working at a high energy expenditure (70-80% of max heart rate)?
   _____
5. How stressed did you feel during class, marked on the line below?
   Not stressed Highly Stressed
   _____

Addendum 2: *Class 1 (Day 9) Structure*

Class 1: Activity Description	Estimated Energy Level of Students	Time	% of Class Time
Teaching/Review of warm-up	Sedentary	02:27.9	4.1%
Warm-up	Sedentary/Low	04:50.9	8.1%
Teaching/Explaining of “Head-Tail” combination	Sedentary	01:06.0	1.8%
Students perform “Head-Tail” connection exercise (including planks, rolls from tail to head, upward dog)	Low	02:08.4	3.6%
Corrections/Reviewing previous combination with teacher	Low	02:48.3	4.7%
Floor exercise ("modern dance pliés,” slides, x-rolls)	Moderate	02:38.8	4.4%
Corrections/Answering questions for previous exercise	Sedentary	02:44.8	4.6%
Repeat floor exercise	Moderate	02:26.7	4.1%
Water break	Sedentary	01:13.8	2.0%
Explanation of “across the floor” phrase	Sedentary	01:13.8	2.0%
Time for students to review “across the floor” phrase on their own	Low	01:49.4	3.0%
Students perform “across the floor” phrase (4 at a time, 11 sec. per group, 3 crosses per group; 3rd one sped up)	Moderate	02:43.2	4.5%
Teacher answers questions	Sedentary	01:08.3	1.9%
Repeat “across the floor” exercise on left side	Moderate	04:01.6	6.7%
Water Break	Sedentary/Low	00:54.9	1.5%
Teaching of 2nd “across the floor” exercise	Low	02:53.9	4.8%
Work through 2nd “across the floor” exercise in pairs	Low/moderate	02:38.0	4.4%
Students mark through the exercise with musician	Low	01:11.3	2.0%
Students perform 2nd “across the floor” exercise (14 sec. per across the floor, groups of 4 students, 2 times per group)	Moderate/High	01:55.8	3.2%
Time given for students to figure out/ reverse 2nd “across the floor” exercise for performance on left side	Low	01:03.2	1.7%
2nd “across the floor” exercise performed on Left side (14 sec. per across the floor, groups of 4 students, 2 times per group)	Moderate	01:56.1	3.2%
Reorganization of class	Low	01:08.3	1.9%
Improvisation (Students instructed to work at an 80% effort)	Moderate/High	00:44.2	1.2%
Improvisation (Students instructed to work at a 90% effort)	Moderate/High	01:16.1	2.1%
Improvisation (Students instructed to work at 100% effort)	High	02:43.3	4.5%
Improvisation (Students instructed to perform "late for class" walk)	High	00:40.1	1.1%
Improvisation (Students instructed to work at a 70% effort and on the floor; "trace the space with a body part")	Moderate/High	01:15.6	2.1%
Improvisation (Students instructed to "find your way to a buddy, use their energy as fuel")	Moderate	01:30.5	2.5%
Improvisation (Students instructed to "keep moving, but find a place on the floor")	Low	02:16.5	3.8%
Students instructed to "Find their way to standing in a circle"	Low	00:33.4	0.9%
Standing Rest/ Deep breaths / Head rolls to forward fold and back to standing	Low	02:07.3	3.5%

Addendum 3: *Class 2 (Day 53) Structure*

Class 2: Activity Description	Estimated Energy Level of Students	Time	% of Class Time
Improvisation (Students instructed to "cycle through your breath" and complete a "body scan")	Sedentary/Low	02:16.0	3.8%
Improvisation (Students instructed to find a little bit of movement, spiral, begin to wake up and work at a 10% effort)	Sedentary/Low	01:22.6	2.3%
Improvisation (Students instructed to work at a 20% effort; "begin to find vertical and see more of the space")	Low	00:44.4	1.2%
Improvisation (Students instructed to work at a 30% effort and find "pressing, spreading, releasing")	Low	00:55.1	1.5%
Improvisation (Students instructed to work at a 50% effort)	Low/ Moderate	01:03.1	1.8%
Improvisation (Students instructed to work at a 60% effort and "paint the space, take more risk, and find negative space")	Moderate	01:38.6	2.7%
Improvisation (Students instructed to work at an 80% effort and "release, toss, and throw your limbs")	Moderate/High	01:37.8	2.7%
Improvisation (Students instructed to work at a 90% effort)	High	00:37.0	1.0%
Improvisation (Students instructed to work at a 100% and "work harder, see the whole space, toss yourself, messy jog)	High	02:30.4	4.2%
Improvisation (Students instructed to perform "late for class walk)	Moderate	00:32.0	0.9%
Improvisation (Students instructed to try to touch someone else's belly button)	Moderate/High	00:23.8	0.7%
Improvisation (Students instructed to walk around the space and find floating)	Moderate	00:55.1	1.5%
Improvisation (Students instructed to work at a 40% energy level	Low/Moderate	01:01.3	1.7%
Improvisation (Students instructed to work at a 20% effort)	Low	00:46.5	1.3%
Improvisation (Students instructed to keep moving at a 10% effort while reviewing the next exercise)	Low	01:40.0	2.8%
Exercise including planks, boat pose, floor-work, and one cartwheel to plank	Moderate	02:42.7	4.5%
Water Break	Sedentary	00:53.3	1.5%
Inversions around the room	Moderate	01:32.5	2.6%
Inversions continued with sun salutation insert	Moderate	04:07.1	6.9%
Prances around the room	Moderate	00:59.3	1.6%
Water Break while simultaneously watching and learning the next dance phrase	Low	01:10.1	1.9%
Students perform 1st dance phrase	Low/Moderate	01:14.5	2.1%
Pause to ask and answer questions	Low	00:32.0	0.9%
Repeat phrase	Low/Moderate	01:07.3	1.9%
Demonstration and learning of 2nd phrase including side falls, floor rolls, inversions, and knee spins	Low/Moderate	01:52.2	3.1%
Group marks through phrase together with accompanist	Moderate	00:28.4	0.8%
Dancers perform 2nd dance phrase	Moderate	01:01.2	1.7%
Teacher adds more choreography to phrase and students learn	Low	01:43.7	2.9%

Class 2: Activity Description	Estimated Energy Level of Students	Time	% of Class Time
Group marks through phrase together with accompanist	Moderate	00:46.5	1.3%
Dancers perform 2nd dance phrase	Moderate/High	01:55.3	3.2%
Water Break and review phrase simultaneously	Sedentary/Low	01:01.8	1.7%
Time for students to review phrase	Low	00:44.0	1.2%
Students circle around teacher and watch teacher perform phrase	Sedentary	01:02.3	1.7%
Students perform phrase two through	Moderate/High	01:36.1	2.7%
Work in pairs to add on to the phrase one at a time	Low	01:20.2	2.2%
The student pairs alternate performing the phrase	Watcher: Low Dancer: Moderate	03:44.7	6.3%
Sweat Wipe	Sedentary	01:58.3	3.3%
Teacher explanations of improvisation addition into phrase	Low	00:49.6	1.4%
Students perform 2nd dance phrase with improvisation before and after	Moderate/High	01:15.1	2.1%
Light walk around room	Low	00:11.8	0.3%
Students perform 2nd dance phrase with improvisation before and after	Moderate/High	01:11.1	2.0%
Exercise including walking in plank position, jogging in place, and prancing backwards	Moderate	02:10.5	3.6%
Students are instructed to find a spot on the floor, find your breath, and allow your body to cool down	Sedentary	02:38.6	4.4%

Addendum 4: *Class 3 (Day 91) Structure*

Class 3: Activity Description	Estimated Energy Level of Students	Time	% of Class Time
Improvisation (Students instructed to begin by laying on the floor, taking a minute to arrive and breath)	Sedentary	01:27.9	2.5%
Improvisation (Students instructed to find the pressure of their body against the floor and let that phenomena lead to movement)	Sedentary	02:48.2	4.8%
Improvisation (Students instructed to find locomotion through "thick fluid, maybe honey")	Sedentary/Low	02:27.1	4.2%
Improvisation (Students instructed to begin moving a bit more vigorously and to find release and rebound between activities.)	Low	02:06.7	3.7%
Improvisation (Students instructed to find verticality and perform slow but fully engaged and activated movements)	Low	01:11.3	2.1%
Improvisation (Students instructed to pick up the pace of their movements, fall through space, and find a sense of their head weight)	Low	03:15.9	5.6%
Improvisation (Students instructed to "work harder" and as if they were going through a "thick material")	Low/ Moderate	02:12.9	3.8%
Improvisation (Students instructed to find their way to the edge of the space)	Low	01:01.2	1.8%
Warm up/ Exercise 1 (including rolls through the spine, bounces, planks, locomoting planks, hip circles)	Low/Moderate	02:19.4	4.0%
Water Break and Explanation of Exercise	Sedentary	01:24.6	2.4%
Exercise 2 (including spinning sit ups)	Low/Moderate	02:20.8	4.1%
Break/Stretching/Teacher explains exercise	Sedentary	01:40.4	2.9%
Exercise 3 ("across the floor" including boat pose, V- sit ups, rolls, floor-work slides, planks, side falls)	Moderate	03:00.7	5.2%
Water Break	Sedentary	00:37.4	1.1%
Explanation of next exercise including light mark through with accompanist	Sedentary/Low	00:59.4	1.7%
Students perform leg swing exercise	Low/Moderate	02:23.6	4.1%
Corrections from teacher	Sedentary	01:13.2	2.1%
Students review a jump exercise from previous class	Low	02:10.3	3.8%
Students perform jump exercise (including pas de chats, brisé, leg extensions, and turning jumps) Exercise is performed in two groups, 3 times per group, approximately 17.5 seconds per run	Moderate	01:21.4	2.3%
Teacher answers questions on timing and dancers mark through exercise with accompanist	Low	01:29.0	2.6%
Students repeat exercise on left side	Moderate	01:25.0	2.5%
Students are instructed to mark through and review exercise on their own	Low	02:13.2	3.8%
Repeat exercise again to Left	Moderate	01:54.8	3.3%
Water Break	Sedentary	01:37.4	2.8%
Quiet Learning of first dance phrase and one mark through with accompanist (including leg extensions, torso articulation, floor-work)	Low/Moderate	05:37.3	9.7%
Time for students to figure out dance phrase	Low	00:54.7	1.6%
Short Pause and Explanation by teacher	Sedentary	00:21.6	0.6%
Performing dance phrase in groups (each group working approximately 50 seconds, 3 times per group)	Moderate	05:05.1	8.8%
Students make a circle, light jog and bounce to cool down	Moderate	00:34.6	1.0%
Students are instructed to find their backspace and forward fold	Low	00:33.8	1.0%