*Adapted Physical Activity Quarterly,* 2013, 30, 254-270


ADAPTED PHYSICAL ACTIVITY QUARTERLY
Official Journal of IFAPA
www.APAQ-Journal.com
RESEARCH

# Three Frameworks to Predict Physical Activity Behavior in Middle School Inclusive Physical Education: A Multilevel Analysis

**Jooyeon Jin**
University of Wisconsin-La Crosse

**Joonkoo Yun**
Oregon State University

The purpose of this study was to examine three frameworks, (a) process-product, (b) student mediation, and (c) classroom ecology, to understand physical activity (PA) behavior of adolescents with and without disabilities in middle school inclusive physical education (PE). A total of 13 physical educators teaching inclusive PE and their 503 students, including 22 students with different disabilities, participated in this study. A series of multilevel regression analyses indicated that physical educators' teaching behavior and students' implementation intentions play important roles in promoting the students' PA in middle school inclusive PE settings when gender, disability, lesson content, instructional model, and class location are considered simultaneously. The findings suggest that the ecological framework should be considered to effectively promote PA of adolescents with and without disabilities in middle school PE classes.

*Keywords:* process-product, student mediation, classroom ecology

Physical activity (PA) is a complex behavior and becomes more complicated during physical education (PE) as it is influenced by many intrapersonal (e.g., intentions), interpersonal (e.g., PE teachers and interactions between children with and without disability), and environmental (e.g., lesson contents, class locations, and instructional model) factors (Lee, 2003; Spence et al., 2010). A theoretical framework may be required to understand the determinants of PA behavior in PE environments. However, research on the PA behavior of adolescents generally lacks sufficient theoretical foundation to investigate variables that influence the PA behavior (Motl, 2007), and very little attention has been paid to the theoretical approaches that could provide a deeper understanding of adolescents' PA behavior

Jooyeon Jin is with the Department of Exercise & Sport Science at University of Wisconsin-La Crosse in La Crosse, Wisconsin. Joonkoo Yun is with the College of Public Health and Human Sciences at Oregon State University in Corvallis, Oregon.

within inclusive PE settings. Therefore, a sound theoretical framework is warranted for moving beyond intuition to systematically understand adolescents' PA behavior during school PE classes. According to Doyle (1977; 1986), students' PA behavior in PE could be explained by three frameworks: (a) the process-product framework, (b) the student mediation framework, and (c) the classroom ecology framework.

First, the process-product framework advocates that teacher behavior directly influences students' achievement (Lee, 2003). For example, if a PE teacher frequently provides feedback, such as "You are trying really hard; I like that effort," the student will be more physically active in comparison with students taught by other PE teachers who rarely provide feedback. This process-product approach guided inquiry within the field of PE pedagogy, and it helped initially to understand the teaching-learning mechanism, but the research findings were inconclusive (Lee, 2003). Silverman, Tyson, and Krampitz (1992) found that teachers' feedback behavior in PE was not related to students' motor skills, and Lee, Keh, and Magill (1993) showed that the role of teacher feedback on student motor skill learning was questionable. One possible reason for the conflicting findings may be due to methodological issues. For instance, most studies investigating teaching-learning relationships in PE were based on a correlational design that is inappropriate because students are nested within teachers (Silverman & Solmon, 1998). Multilevel analysis may be necessary to gain a better understanding of the relation between teachers' PA promotion behavior (process) and students' PA behavior (product) in PE settings.

The second conceptual framework of the teaching-learning mechanism is the student mediation framework that extends the process-product framework by including cognitive mediator between teacher behavior and student achievement (Lee & Solmon, 2005). Based on prior knowledge and past experience, students select cognitive operations to employ during PE lessons, and they choose the aspects of instruction to which they attend, as well as the degree to which they attend (Solmon & Lee, 1996). According to Bandura (1997) and Dzewaltowski (1994), psychological factors are strong predictors of PA participation at any age. For instance, if a student has a strong intent to be physically active for most PE time, the student is likely to do so because intention is an immediate determinant to behavior (Ajzen, 2002; Bandura, 1997; Greenockle, Lee, & Lomax, 1990; Kodish, Kulinna, Martin, Pangrazi, & Darst, 2006). In particular, implementation intentions (II) are considered the most proximal predictor of behavior in that II plays a vital role in translating motivation into action with specific plans (i.e., how, where, and when; Gollwitzer, 1993; Roberts et al., 2010). Despite the promising conceptual features, this mediation framework has rarely been examined in PE classes. Consequently, fundamental questions still remain, such as "Do students' II mediate the relation between teachers' PA promotion behavior and the students' PA behavior in PE?"

The classroom ecology framework focuses on mutual relations among environmental demands and human responses in classroom settings (Doyle, 1977). In other words, this integrated approach places more emphasis on how teachers and students interact in the context of learning environments (Lee, 2003). In school PE environments, according to Graber (2001), the teaching-learning process can be affected by a complex set of aspects, such as student characteristics (e.g., gender and disability) and instructional contexts (e.g., lesson contents, class location, and instructional models). Among adolescents, PA behavior during PE is different typically by gender. For example, McKenzie, Prochaska, Sallis, and LaMaster (2004)

found that boys were more active than girls in middle school PE. Disability also is a very important determinant of PA behavior (van der Ploeg, van der Beek, van der Woude, & van Mechelen, 2004). Many researchers found that adolescents with disabilities were relatively less active than their peers without disabilities in PE (Foley et al., 2008; Lieberman, Dunn, van der Mars, & McCubbin, 2000; Sit, McKenzie, Lian, & McManus, 2008).

In terms of effects of instructional contexts on students' PA in PE, Chow, McKenzie, and Louie (2008; 2009) revealed that the PA behavior of adolescents during PE varied substantially with lesson contents (e.g., students would be substantially more active in soccer than gymnastics). McKenzie, Marshall, Sallis, and Conway (2000) demonstrated that students were active more in outdoor lessons than indoor lessons in middle school PE. Students' PA behavior in PE also was significantly different by instructional model such that a game/sport model led to students doing more steps during PE, compared with the skill themes and the fitness models (Culpepper, Tarr, & Killion, 2011). These factors in student characteristics and instructional contexts are interrelated to each other rather than separately isolated, but there have been few research efforts to examine this ecologically interrelated framework to understand the teaching-learning mechanisms during PE. According to Lee (2003), researchers in PE pedagogy have paid little attention to the variations among teachers and how subject matter and context interact with the motivational and cognitive beliefs of students.

The three frameworks have been used as promising theoretical structures in many studies for understanding of the complicated teaching-learning mechanism in PE classes. For example, Solmon and Lee (1996) used the student mediation model to investigate how students mediate instructions in PE classes. Supaporn, Dodds, and Griffin (2003) investigated how the classroom ecology influenced students' understandings of misbehavior in a PE setting. However, the frameworks have not been considered as theoretical frameworks to systematically understand the relationships of teaching behavior and PA behavior of students with and without disabilities in inclusive PE settings. According to Kodish, et al. (2006), researchers have continuously called for additional studies on PA behavior using more diverse samples in a variety of inclusive PE settings. Therefore, the purposes of the current study were to (a) examine whether teachers' PA promotion behavior directly influences students' PA behavior; (b) examine whether students' II mediates the relation between the physical educator's PA promotion behavior and the students' PA behavior; and (c) examine whether gender, disability, lesson contents, instructional models, and class location influence the triadic relationship of teachers' PA promotion behavior, students' II, and students' PA behavior in middle school inclusive PE classes.

# Method

## Participants

***Teachers.*** A total of 13 certified PE teachers (8 males and 5 females) who teach inclusive PE classes at middle schools ($n = 8$) in Seoul, Korea, and the surrounding suburbs, volunteered to take part in this study. The age range of the teacher participants was 25- to 50-years-old (M = 36.31, $SD = 7.66$). A majority of the teachers

had a bachelor's degree (61.54%), less than 10 years of PE teaching experiences (76.92%), less than 5 years of inclusive PE teaching experiences (76.92%), and no access to an Individualized Education Program (IEP) for students with disabilities in the inclusive PE classes (92.31%). Most teachers answered that the primary goal of PE is PA promotion (26%) or social development (23%).

***Students.*** A total of 572 participants in the sixth to eighth grades (305 boys and 267 girls) from the teachers' classes participated in this study. The spread of each grade was 66% (sixth grade), 28% (seventh grade), and 6% (eighth grade). A total of 23 students with disabilities (18 boys and 5 girls) were included in the total number of student participants from 20 classes, and at least one student with a disability was part of the class. The types of disabilities are presented in Table 1, and all 23 students with disabilities were capable of answering questionnaires and walking independently without additional mobility assistance, such as chairs, crutches, and canes. Among the 23 students with disabilities, 22% ($n = 5$) were fully included and 78% ($n = 18$) were partially included in the regular classrooms. Unlike teachers, most students, including students with disabilities, marked fitness development (30%) or motor skill acquisition (28%) as a major goal of PE.

After screening, approximately 12% ($n = 69$) of student participants, including one student with intellectual disability, was deleted as they had at least one missing value on their questionnaire and PA data. The final sample contained a total of 503 student participants, including 22 students with disabilities, nested within 13 teacher participants in eight middle schools. This study was approved by the university institutional review board. Informed consent forms were obtained from all the teacher participants, the student participants with and without disabilities, and the students' parents. In addition, verbal approvals from all the school principals were given before the data collection.

## Instruments

Three different instruments were used to collect data: (1) survey questionnaires for students' implementation intentions, (2) electronic pedometers for students' PA behavior, and (3) direct observation for teachers' PA promotion behavior.

***Questionnaires.*** Implementation intentions (II) were measured by paper-and-pencil questionnaires. Three II items were adapted from scales of Roberts et al. (2010), and assessed the extent to which students had formed a detailed plan regarding when, how, and how often to be physically active in inclusive PE classes. The three items were "I have made a detailed plan regarding *when* (intro, fitness, game, etc.) to be physically active for more than 25 minutes of 45 minutes class time"; "I

**Table 1 Disability Types of 23 Participants With Disabilities**

| ID | DS | DD | ASD | ADHD | VI | HI | CP |
|---|---|---|---|---|---|---|---|
| 12 | 2 | 2 | 1 | 2 | 1 | 2 | 1 |

*Note.* ID = intellectual disability, DS = Down syndrome, DD = developmental disability, ASD = autism spectrum disorder, ADHD = attention deficit hyperactivity disorder, VI = visual impairment, HI = hearing impairment, CP = cerebral palsy

have made a detailed plan regarding *how* to be physically active for more than 25 minutes of 45 minutes class time"; and "I have made a detailed plan regarding *how often* to be physically active for more than 25 minutes of 45 minutes class time." A 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree) was used for each item. Students were asked to answer two additional questions regarding gender and the primary goal of PE as background information.

All questionnaire items in English were translated into Korean by the author who is bilingual in English and Korean, and content-related validity evidence was evaluated using four steps suggested by Yun and Ulrich (2002). First, operational definitions of theoretical constructs were developed to help content experts make judgments. Second, a panel of judges was organized with nine experts who have academic (e.g., PA, exercise psychology, PE, measurement, and survey research) and practical backgrounds (e.g., PE teaching experience) to evaluate the content relevance of the questionnaires. Five bilingual college professors who have research experiences in both Korean and U.S. populations and three certified PE teachers working at secondary level schools in Korea were invited. All the teachers had teaching experience in inclusive PE classes for many years (7–11 years). In addition, a professor who worked at the Korea Institute for Curriculum and Evaluation provided feedback (e.g., appropriate survey terminologies in school settings) to improve the readability of the questionnaire. Third, two groups of experts were asked to review the questionnaire. Finally, directions, grammar, and wording in each section of the questionnaire were revised based on the recommendations of the panel of judges.

***Pedometers.*** The HJ-720ITC model (Omron Healthcare, Bannockburn, IL) of pedometers was used to objectively assess the amount of students' PA by counting steps during inclusive PE classes. This electronic pedometer measures vertical movements by counting steps through a pair of electronic sensors along with sophisticated internal circuitry (Pedometer Reviews, 2011). The accuracy, reliability, and validity of pedometers measuring the steps in PE classes have been demonstrated through previous research in adolescents at middle schools (Gao et al., 2010; Kodish et al.,2006; Scruggs, 2007a, 2007b). For instance, Gao et al. demonstrated that a pedometer is a valid method to assess students' PA levels in middle school PE classes. In addition, Kodish et al. successfully used pedometers to measure PA levels of students with and without disabilities in inclusive PE classes. Before data collection, all pedometers were calibrated using the "shake-test" developed by Vincent and Sidman (2003). No pedometers exceed ±10% error that is ±10 steps out of 100.

***Direct observation.*** A systematic observation instrument adapted from the McKenzie's System for Observing Fitness Time [SOFIT] (2009) was used to assess physical educators' teaching behavior that promotes students' PA during inclusive PE classes. This instrument was selected due to its capability to produce reliable and valid scores of PA promotion teaching behavior (McKenzie et al., 2006; Martin & Kulinna, 2005). Using this observation tool, the author collected the total amount of time teachers spend to promote students' PA in five categories: (a) feedback, (b) prompts/cueing, (c) demonstration, (d) out-of-class PA promotion, and (e) no PA promotion. Table 2 represents operational definitions of the five categories of teaching behavior that the current study used.

**Table 2 Definitions of Teaching Behavior Observed**

| | |
|---|---|
| F | a. *Verbal positive feedback*: Providing a commendatory statement that is supportive in nature of students' physical activity/fitness and motor technique responses (e.g., outstanding, super, and great job) |
| | b. *Verbal positive specific technique feedback*: Providing a commendatory verbal statement that reflects a positive value judgment of students' technique responses and includes exact information for the student (e.g., your weight was distributed well this time) |
| | c. *Nonverbal positive feedback*: Providing a commendatory nonverbal movement that reflects a positive value judgment of students' performance on technique executions (e.g., high fives, thumbs up, and/or smiles) |
| P/C | Providing specific verbal reminders for previously acquired techniques that can be used to promote a subsequent student physical activity/fitness or motor skill engagement (e.g., attempts to initiate or increase student engagement in a physical or fitness activity) |
| D | Displaying (part of) a technique in support of verbal instructions regarding the skill (e.g., teacher showing a forward roll, different options for a ball carrier, and/or how to place equipment after use) |
| O | Promoting out-of-class physical activity/fitness and motor skill engagement beyond a PE lesson by the teacher |
| N | Promoting neither in-class nor out-of-class physical activity/fitness and motor skill engagement by the teacher |

*Note.* F = feedback, P/C = prompting/cueing, D = demonstration, O = out-of-class physical activity promotion, N = no physical activity promotion

## Procedures

***Implementation intentions.*** The questionnaires were administered to students with and without disabilities in their inclusive PE classes. The researcher provided a brief introduction and explained directions to complete the questionnaires. PE teachers assisted with survey administration, such as additional explanations and survey distributions. The researcher provided further assistance to students with disabilities in comprehension of the survey questions. For those with disabilities who are struggled to answer the questionnaires in a designated time (i.e., 10–15 min), the researcher administered the questionnaires in the students' special education classrooms. The special education teachers assisted the students with disabilities to be sure that they understood the questions before answering.

***Physical activity.*** After completing questionnaires, the researcher provided an orientation for each class of students to explain the pedometer. During this orientation, the researcher taught student participants about how the device is operated and how to wear it, as well as answered questions and allowed students to wear the devices. After one week from the orientation, pedometer data were collected three separate times in inclusive PE classes. The length of wear time was based on previous research recommending that three days of PA monitoring

are appropriate to obtain acceptable reliability levels when using pedometers in children (Vincent & Pangrazi, 2002). The pedometers were sealed during all three days for three reasons: (a) to eliminate interinstrument error, (b) to ensure that students would not reset and tamper with the device (Kodish et al., 2006), and (c) to minimize reactivity as a confounding variable that could potentially alter the results and jeopardize the validity of the study (Vincent & Pangrazi). The pedometers were distributed to each student when the PE teachers were taking roll, and students were asked to return the device to the researcher at the end of each class. Students' step counts were not converted to a percentage score because all schools had the same class length (i.e., 45 min).

***Teaching behavior.*** Physical educators' teaching behaviors in teaching physically active lessons in inclusive PE classes were directly observed by the researcher using the modified observation instrument. The live observations were conducted three separate times per class while students were wearing pedometers. Momentary time sampling was used with audio cueing of 10 s "observe" and 10 s "record" to code teachers' teaching behavior in five categories (see Table 2). Due to different teaching lengths in each class, teaching behaviors were converted to a percentage score. There were three different types of lesson contents across the 60 observed classes as follows: gymnastics/target/striking related lessons (gymnastics, jump-band, gateball, & t-ball), net/court/field related lessons (badminton, kickball/dodgeball, long jump), and track/invasion lessons (relay and soccer). Approximately, 27% of lessons ($n$ = 16) were taught in an indoor gymnasium and 63% ($n$ = 44) were taught on an outside playground. Traditional instruction model (i.e., warm-up, fitness, main lesson, and game) was used in 75% of lessons ($n$ = 45), and sport education model was used in 25% of lessons ($n$ = 15). Table 3 shows each teacher's demographic information and the corresponding students' average step counts.

## Analytical Strategies

Due to a two-level data structure (i.e., students were nested within teachers), separate multilevel regressions were conducted with maximum likelihood estimation (ML) to test the three conceptual frameworks explaining PA behavior: (a) to test the dyadic relationship between teachers' PA promotion behavior and students' PA behavior; (b) to test the triadic relationship of teachers' PA promotion behavior, students' II, and the students' PA behavior; and (c) to test effects of gender, disability, lesson contents, instructional models, and class location on the triadic relationship. Dyadic (2→1) and Triadic (2→1→1) analytical models were used to test the three frameworks where the numbers represent level-1 and level-2 study variables. For instance, the 2→1 model illustrates that a level-2 variable (i.e., teachers' behavior) influences a level-1 variable (i.e., students' II). With the same idea, the 2→1→1 model illustrates that a level-2 variable (i.e., teachers' behavior) influences a level-1 variable (i.e., students' II) that affects another level-1 variable (students' PA). To evaluate how much variance of the student level data depends on the teacher level data, the intraclass correlation coefficient (ICC) was calculated using equation 1 that is the intercept only model.

$$Y_{ij} = r_{00} + u_{0j} + e_{ij}$$

**Table 3 Teachers' Demographic Information With Students' Average Step Counts**

| | Gender | Final Degree | Teaching Experience | Lesson Planning | SASC |
|---|---|---|---|---|---|
| Teacher 1 | Female | Masters | <5yrs | Yes | 1222.92 |
| Teacher 2 | Male | Bachelor | 6–10yrs | No | 1663.12 |
| Teacher 3 | Male | Bachelor | <5yrs | Yes | 996.82 |
| Teacher 4 | Male | Bachelor | 6–10yrs | Yes | 1022.19 |
| Teacher 5 | Male | Bachelor | 6–10yrs | No | 741.99 |
| Teacher 6 | Male | Bachelor | <5yrs | Yes | 1657.75 |
| Teacher 7 | Male | Masters | <5yrs | Yes | 842.82 |
| Teacher 8 | Male | Masters | >21yrs | No | 1372.21 |
| Teacher 9 | Female | Masters | <5yrs | Yes | 761.84 |
| Teacher 10 | Male | Bachelor | 6–10yrs | Yes | 1377.06 |
| Teacher 11 | Female | Bachelor | >21yrs | Yes | 1500.93 |
| Teacher 12 | Female | Masters | >21yrs | Yes | 2061.17 |
| Teacher 13 | Female | Bachelor | 6–10yrs | Yes | 928.55 |

*Note.* SASC = Students' average step counts in the teacher's class(es)

First, a 2→1 multilevel regression, equation 2, was used to test whether teachers' PA promotion behavior as an initial variable influences students' PA behavior as an outcome variable. The two numbers indicate that the teachers' behavior ($Z_{1j}$) measured at level 2 predicts the student PA ($Y_{ij}$) measured at level 1, where i and j refer to students and teachers, respectively.

$$Y_{ij} = r_{00} + r_c Z_{1j} + u_{0j} + e_{ij}$$

Second, a 2→1→1 multilevel mediation model, representing that the teachers' behavior measured at level 2 affects the students' II measured at level 1, which, in turn, affects students' PA measured at level 1, was used to test whether students' II mediates the relationship between teachers' behavior and the students' PA. Based on the procedures suggested by Krull and MacKinnon (2001), the multilevel mediation analysis was conducted to establish the mediating effects. Students' II ($X_{1ij}$), as a mediator, was predicted by the initial variable, teachers' behavior ($Z_{1j}$), using equation 3.

$$X_{1ij} = r_{00} + r_a Z_{1j} + u_{0j} + e_{ij}$$

The outcome variable, students' PA ($Y_{ij}$), was predicted by the initial variable and the mediator simultaneously using the equation 4.

$$Y_{ij} = r_{00} + \beta_b X_{1ij} + r_{c`} Z_{1j} + u_{0j} + e_{ij}$$

Where both $r_a\hat{}$ and $\beta_b\hat{}$ are significant, the product of $r_a\hat{} \times \beta_b\hat{}$ estimated the mediated effects (indirect effect), which evaluates the extent to which the initial

variable affects the mediator and the extent to which the mediator, in turn, affects the outcome variable. In equations (2), (3), and (4), the subscript '$r_c$' and '$r_{c'}$' were the coefficients representing the total and direct relationships, respectively, between teachers' behavior and students' PA. The relationship between teachers' behavior and students' II was labeled as '$r_a$', and the relationship between the mediator and the students' PA was labeled as '$\beta_b$'. The intercepts were treated as random and the slopes were constrained to be fixed for all regression equations.

Finally, a series of separate 2→1→1 multilevel regressions were used to test whether gender ($X_{2ij}$), disability ($X_{3ij}$), lesson contents ($Z_{2j}$), class location ($Z_{3j}$) and instructional models ($Z_{4j}$; GDLCI) influence the triadic relationship of teachers' behavior ($Z_{1j}$), students' II ($X_{1ij}$) and student PA behavior ($Y_{ij}$). The first analysis regressed students' PA onto their II with GDLCI and an interaction term of students' II × gender, students' II × disability, students' II × lesson contents, students' II × class location, and students' II × instructional model in the separate equation models. The second analysis regressed students' II onto teachers' behavior with GDLCI and an interaction term of teacher behavior × gender, teacher behavior × disability, teacher behavior × lesson contents, teacher behavior × class location, and teacher behavior × instructional model in the separate equation models. The third analysis regressed students' PA onto teachers' PA promotion behavior with GDLCI and an interaction term of the same set in the second analysis. The fourth analysis regressed students' PA behavior onto GDLCI. The fifth analysis regressed teachers' PA promotion behavior onto GDLCI. Finally, the sixth analysis regressed students' II onto GDLCI.

Item analysis using Cronbach's alpha was conducted to test internal consistency of students' II. Stata 12.0 (StataCorp, 2011) was used for the multilevel regression analyses.

## Results

As shown in Table 4, approximately half of the teachers ($n = 6$) spent at least 30% of lesson time promoting students' PA in class, but all the teachers seldom promoted out of class PA participation. Internal consistency of students' II (M = 2.65, *SD* = 1.02) was .92. The average of pedometer step counts across all students and teachers was 1241.41 steps. Both student-level and teacher-level variances were significant ($p < .05$) and the ICC was .40. This ICC means 40% of the variance in students' PA was explained at the teacher level, confirming the need for multilevel analyses.

As shown in Figure 1, the multilevel regression analysis for the dyadic model yielded no significant effect of teachers' PA promotion behavior on students' PA behavior. In terms of the mediation analyses (see Figure 2), regressing students' II on teachers' PA promotion behavior revealed that teachers' teaching behavior did not directly influence students' II, and students' II in regression intercept did not significantly vary across teachers. Students' II ($\beta = .13$, $p < .001$) significantly influenced the students' PA behavior. After controlling for students' II, the direct effect of teachers' behavior was not significant on the students' PA. These results demonstrated that students' II does not mediate the relationship between teachers' PA promotion behavior and students' PA.

**Table 4 Percentage of Time Teachers Spent for PA Promotion**

| | F (%) | P/C (%) | D (%) | TPP (%) | O (%) | N (%) |
|---|---|---|---|---|---|---|
| Teacher 1 | 36 | 11 | 2.33 | 49.33 | 0 | 50.67 |
| Teacher 2 | 8 | 19 | 0 | 27 | 0 | 73 |
| Teacher 3 | 1.17 | 5.17 | 1 | 7.33 | 0 | 76 |
| Teacher 4 | 26 | 10 | 3 | 39 | 0 | 61 |
| Teacher 5 | 16.67 | 8 | 3.33 | 28 | 0 | 72 |
| Teacher 6 | 13 | 5.67 | 2.67 | 21.33 | 0 | 78.67 |
| Teacher 7 | 12.33 | 12.33 | 8.67 | 33.33 | 0.67 | 66 |
| Teacher 8 | 2.39 | 5.39 | 0.22 | 7.9 | 0 | 92.1 |
| Teacher 9 | 31.3 | 22.2 | 11 | 64.5 | 0.5 | 34.5 |
| Teacher 10 | 5.33 | 6 | 9 | 20.33 | 0 | 79.67 |
| Teacher 11 | 10.83 | 10.17 | 2.67 | 23.67 | 0 | 76.33 |
| Teacher 12 | 5.92 | 25.08 | 2.42 | 33.42 | 0 | 66.58 |
| Teacher 13 | 17.33 | 11.33 | 2.33 | 31 | 0 | 69 |

*Note.* F = feedback, P/C = prompting/cueing, D = demonstration, TPP = total physical activity promotion, O = out-of-class physical activity promotion, N = no physical activity promotion

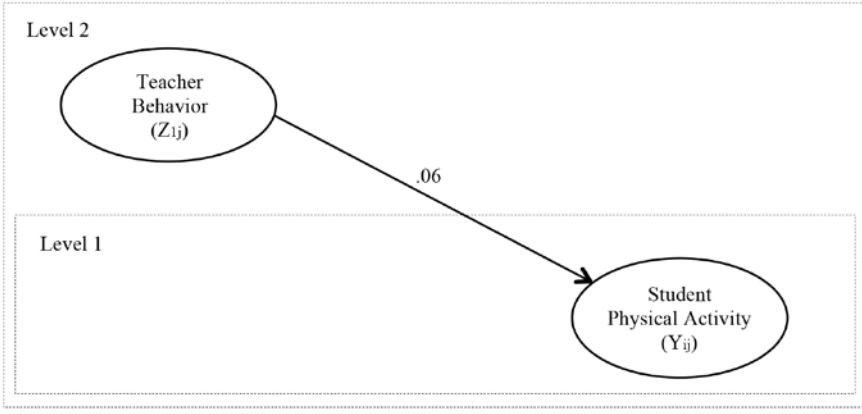


**Figure 1** — Standardized coefficients (β) of the multilevel process-product model.

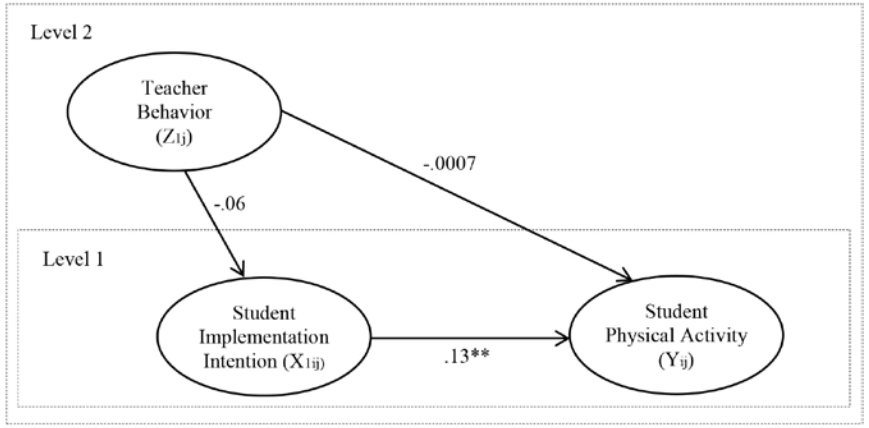


**Figure 2** — Standardized coefficients (β) of the multilevel mediation model.
Note. $^{**}p < .001$

With respect to effects of gender, disability, lesson contents, class location, and instructional model on the triadic relationship (see Figure 3), GDLCI were controlled first on the relationship of students' II and PA using the following model: $Y_{ij} = r_{00} + \beta_{b1}X_{1ij} + u_{0j} + e_{ij}$. Students' II (β=.08, $p < .05$) significantly accounted for their PA behavior, albeit with small effect size, after adjusting for GDLCI. Next, interaction terms were included in the equation model to investigate whether GDLCI moderates the effect of students' II on PA behavior. The II × lesson content interaction (β=.20, $p < .05$) and the II × class location interaction (β= -.21, $p < .05$) terms significantly predicted PA with medium effect sizes. Interaction terms of II × gender, II × disability, and II × instruction model were not significant.

According to the same procedure, effects of GDLCI were examined on the relationship of teachers' PA promotion behavior and students' II using the following model: $X_{1ij} = r_{00} + r_cZ_{1j} + u_{0j} + e_{ij}$. There was no significant effect of teachers' PA promotion behavior on students' II, after accounting for GDLCI. Through the moderation analyses, lesson content (β=.48, $p < .05$) and class location (β= -.95, $p < .001$) significantly moderated the effect of teachers' PA promotion behavior on students' II, after accounting for GDLCI. Both interaction effects were large. Interaction terms of teacher behavior × gender, teacher behavior × disability, and teacher behavior × instruction model were not significant. Repeating the same procedure with students' PA behavior as the outcome variable using the following model: $Y_{ij} = r_{00} + r_cZ_{1j} + u_{0j} + e_{ij}$, teachers' PA promotion behavior did not significantly explain students' PA although it was approaching to the significant level (β=.22, $p = .07$), adjusting for GDLCI. Moderation analyses revealed that gender (β= -.21, $p < .001$), class location (β= -.72, $p < .05$), and instructional model (β= -.19, $p < .001$) moderate the effect of teacher's PA promotion behavior on students PA behavior, controlling for GDLCI. The effect sizes were medium to large. Interaction terms of teacher behavior × lesson contents and teacher behavior × disability were not significant.

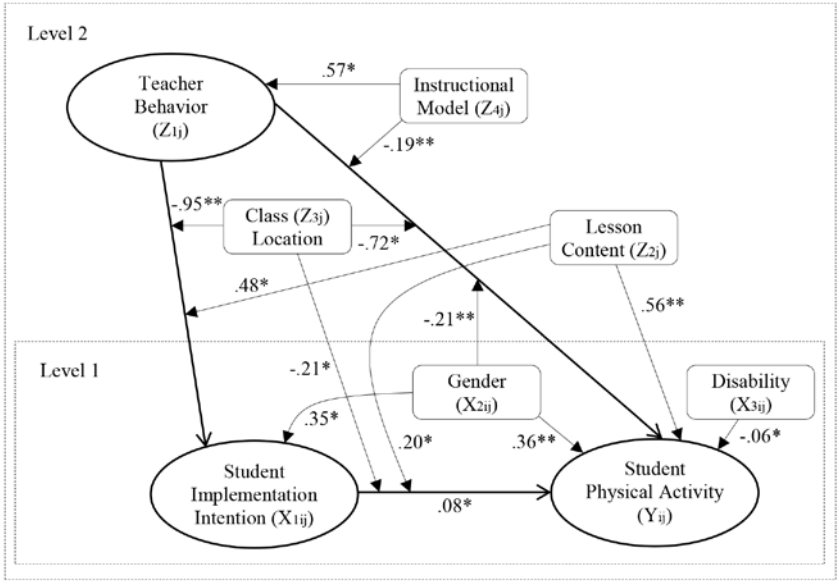


**Figure 3** — Standardized coefficients (β) of the multilevel ecological model.
Note. *$p < .05$, **$p < .001$

Finally, instructional model (β=.57, $p < .05$) was a significant predictor of teachers' PA promotion behavior and class location was marginally significant (β=.30, $p$=.06), controlling for gender, disability, and lesson content. Gender (β=.35, $p < .001$) significantly accounted for students' II, after controlling for disability, lesson content, class location, and instructional model. Students' PA was significantly explained by gender (β=.36, $p < .001$), disability (β= -.06, $p < .05$), and lesson content (β=.56, $p < .001$), after accounting for class location and instructional model. The effect sizes of each predictor were medium to large, except for the small effect of disability.

# Discussion

The purpose of this study was to systematically investigate the relationship between teachers' PA promotion behavior and the PA behavior of adolescents with and without disabilities in middle school inclusive PE settings. This relationship was examined using three conceptual frameworks.

## Process-Product Framework

The process-product framework was initially employed to examine the relationship between teachers' PA promotion behavior and students' PA behavior in inclusive PE environment. An important assumption of this approach was that the teacher is the single most important determinant of student learning

outcomes in education (Doyle, 1977). However, the current study revealed that the teachers' PA promotion behavior did not significantly account for students' PA. This finding is consistent with previous studies suggesting limitations of the two-factor structure of process-product paradigm as a framework to understand the teaching-learning mechanism in PE (Lee 2003; Lee, Keh, & Magill, 1993; Silverman, 1994; Silverman et al., 1992). Although the current study employed a multilevel analysis to investigate the mechanism of PA behavior through the multilevel process-product approach, it became apparent that the process-product framework was inadequate to explain the complex relationship of teachers' PA promotion behavior and students' PA behavior during PE. In sum, the process-product framework may be extended by including other intervening variables at teacher and/or student levels.

## Student Mediation Framework

The student mediation framework, which extends process-product approach, was used to examine whether students' II mediates the relationship between the physical educators' PA promotion behavior and the students' PA behavior in PE. The critical assumption of this framework is that students are active agents in their learning as learners construct knowledge through their own interpretation of events (Solmon, 2003). Unexpectedly, however, it was found that students' II did not significantly mediate the relationship of teachers' PA promotion behavior and their PA behavior in inclusive PE classes. Two reflective suggestions would seem to characterize this result. First, more attention needs to be given to a range of process and mediating variables. Second, without considering a variety of contextual variables, this student mediation framework is not adequate to explain the complexity of the teaching-learning relationships. Unfortunately, to our knowledge, there have been no studies investigating this triadic mediation relationship in school PE settings. Therefore, further research should be warranted to add to scientific knowledge on the student mediation framework through different approaches, such as employing other teaching behavior and student mediators before concluding incapability of this framework.

## Classroom Ecology Framework

The effects of GDLCI on the triadic relationship were investigated using the classroom ecology framework that is an extension of the student mediation framework by including two student characteristic variables (i.e., gender and disability) and three instructional context variables (i.e., lesson content, class location, and instructional model). This framework emphasizes the richness and complexity of classroom settings that is produced by the complex interactions among teachers, students, and settings (Doyle, 1977). Study findings based on this ecological approach can be summarized in four ways. First, the effect of students' II on PA was found to depend on lesson contents, and the effect was weaker for inside locations (i.e., gymnasium) than outside locations (i.e., playground). The larger effect sizes of the interaction effects compared with II's main effect imply that PE teachers should consider the lesson content and class environment to promote PA of students who specifically plan active participation in PE classes. Second, the influence of teaching

effectiveness on students' II relied on lesson content, and the effectiveness was weaker for gymnasium than playground. Third, the effect of teachers' PA promotion behavior on students' PA was weaker for boys than girls, weaker for gymnasium than playground, and weaker for traditional instructional model than the Sport Education Model. Lastly, it was demonstrated that class location and instructional model determine physical educators' PA promotion behavior; and students' gender, disability, and lesson content determine students' PA behavior. These results may guide future researchers who are interested in PA promotion in PE settings, but much more empirical research is necessary before the full interpretive potential of the ecological framework can be realized as mentioned in Doyle's thorough review of education research.

This study provided an initial endeavor to systematically understand the complex mechanism of PA behavior of adolescents with and without disabilities in inclusive PE settings. These study findings may be important theoretically and methodologically for the study of teaching effectiveness and students' PA promotion. Theoretically, this study suggests that the classroom ecology framework is the most useful framework to understand the mechanism of PA behavior of students with and without disabilities in inclusive PE classes. Indeed, the study findings make it possible to link a specific teacher behavior with student achievement. This link has been inconclusive in the field of PE pedagogy for over 30 years. The classroom ecological framework needs further elaboration and refinement, but provides scientific evidence to answer the question "how do instructional effects occur?" to effectively promote students' PA in inclusive PE settings.

Methodologically, this study suggests that a multilevel analysis is required to appropriately answer research questions using intact groups of participants, such as students in PE classes. Using traditional single-level analyses on nested data not only violates the independence assumption among observations, but also may underestimate standard errors resulting in spuriously significant results (Spence et al., 2010). According to Silverman and Solmon (1998), researchers should decide on a unit of analysis at either student level with a lack of independence assumption or teacher level with significant reduction of sample size, but this advice is outdated, as these trade-offs may be no longer necessary with a multilevel analysis technique. Although multilevel analyses are relatively uncommon in the field of PE, future researchers should consider the use of this analysis technique to produce unbiased and credible research evidence.

A few limitations should be acknowledged in this study. First, all data were gathered almost at the same moment during two weeks although students' II was collected a few days before PA and teacher behavior data. This cross-sectional design did not allow the researcher to demonstrate causal relationships. However, data collection was conducted during the second semester of the school year. Thus, it is likely that the relationships are in the established direction as physical educators' teaching behavior may have influenced students' psychological factors and their PA behavior since the beginning of the first semester. Second, schools and classes involved in this study were selected through a convenience sampling method. Results, therefore, may not generalize to other inclusive PE settings. Third, the use of self-administered measures might affect item interpretation and social desirability issues. As an effort to reduce these issues, previously validated and reliable questionnaires were used. Finally, the sample size at the group level (i.e.,

13 teachers in this study) was small for accurate estimation in multilevel analysis. This small number of teachers might lead to biased estimates of the standard errors (Maas & Hox, 2005). Despite those limitations, this study had several strengths, such as objectively measured PA and teacher behavior, validated questionnaires, the theory-based study framework, systematically extended mediation approach, and multilevel analysis to handle the clustered effects.

## Conclusions

In summary, findings of the current study suggest that physical educators' teaching behavior and students' II play important roles in promoting adolescents' PA in middle school inclusive PE settings when gender, disability, lesson content, instructional model, and class location are considered simultaneously. According to Reid, Bouffard, and MacDonald (2012), the field of adapted physical activity has multifactor complexity, such as complex contexts and diversity of students' abilities, and as a result these factors lead to difficulty in determining what works. To overcome this issue, Reid and his colleagues urged that a theoretical framework should be used to systematically understand the complexity. In terms of this viewpoint, the authors believe that the current study made a unique contribution to the field of adapted physical activity by identifying mediators and moderators on the complex teaching and learning mechanism within the context of inclusive PE. It is hoped that future research will elaborate and refine the ecology framework examined in this study, and eventually physical educators consider the mediating and moderating aspects to effectively promote PA of adolescents with and without disabilities during inclusive PE lessons.

### Acknowledgment

This study is based on one of two manuscripts in a doctoral dissertation.

## References

Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology, 32*(4), 665–683 10.1111/j.1559-1816.2002.tb00236.x. doi:10.1111/j.1559-1816.2002.tb00236.x

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W.H. Freeman and Company.

Chow, B.C., McKenzie, T.L., & Louie, L. (2008). Children's physial activity and environmental influences during elementary school physical education. *Journal of Teaching in Physical Education, 27,* 38–50.

Chow, B.C., McKenzie, T.L., & Louie, L. (2009). Physical activity and environmental influences during secondary school physical education. *Journal of Teaching in Physical Education, 28,* 21–37.

Culpepper, D.O., Tarr, S.J., & Killion, L.E. (2011). The role of various curriculum models on physical activity levels. *Physical Educator, 68*(3), 163–171.

Dzewaltowski, D.A. (1994). Physical activity determinants: A social cognitive approach. *Medicine and Science in Sports and Exercise, 26*(11), 1395–1399. PubMed doi:10.1249/00005768-199411000-00015

Doyle, W. (1977). Paradigms for research on teacher effectiveness. In L.S. Shulman (Ed.), *Review of research in education* (Vol. 5, pp. 163–198). Itasca, IL: Peacock.

Doyle, W. (1986). Classroom organization and management. In M.C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 392–431). New York, NY: Macmillan.

Foley, L., Prapavessis, H., Maddison, R., Burke, S., McGowan, E., & Gillanders, L. (2008). Predicting physical activity intention and behavior in school-age children. *Pediatric Exercise Science, 20,* 342–356. PubMed/jrn>

Gao, Z., Lee, A.M., Kosma, M., & Solmon, M.A. (2010). Understanding students' motivation in middle school physical education: Examining the mediating role of self-efficacy on physical activity. *International Journal of Sport Psychology, 41,* 199–215.

Gollwitzer, P.M. (1993). Goal achievement: The role of intentions. *European Review of Social Psychology, 4,* 141–185. doi:10.1080/14792779343000059

Graber, K.C. (2001). Research on teaching in physical education. In V. Richardson (Ed.), *Handbook of research on teaching* (pp. 491–519). Washington, DC: American Educational Research Association.

Greenockle, K.M., Lee, A.A., & Lomax, R. (1990). The relationship between selected student characteristics and activity patterns in a required high school physical education class. *Research Quarterly for Exercise and Sport, 61*(1), 59–69. PubMed doi:10.1080/02701367.1990.10607478

Kodish, S., Kulinna, P.H., Martin, J., Pangrazi, R., & Darst, P. (2006). Determinants of physical activity in an inclusive setting. *Adapted Physical Activity Quarterly, 23,* 390–409.

Krull, J.L. & MacKinnon, D.P. (2001). Multilevel modeling of individual and group level mediated effects. *Multivariate Behavioral Research, 36*(2), 249–277. doi: 10.1207/S15327906MBR3602_06

Lee, A.M. (2003). How the field evolved. In S.J. Silverman & C.D. Ennis (Eds.), *Student learning physical education: Applying research to enhance instruction* (pp. 9–25). Champaign, IL: Human Kinetics.

Lee, A., Keh, N., & Magill, R. (1993). Instructional effects of teacher feedback in physical education. *Journal of Teaching in Physical Education, 12,* 228–243.

Lee, A.M., & Solmon, M.A. (2005). Pedagogy research through the years in RQES. *Research Quarterly for Exercise and Sport, 76,* S108–S121 10.5641/027013605X13100559650245. PubMed doi:10.1080/02701367.2005.10599293

Lieberman, L.J., Dunn, J., van der Mars, H., & McCubbin, J. (2000). Peer tutors' effects of activity levels of deaf students in inclusive elementary physical education. *Adapted Physical Activity Quarterly, 17,* 20–39.

Maas, C.M., & Hox, J.J. (2005). Sufficient sample sizes for multilevel modeling. *Methodology, 1*(3), 86–92 10.1027/1614-2241.1.3.85.

Martin, J.J., & Kulinna, P.H. (2005). A social cognitive perspective of physical-activity-related behavior in physical education. *Journal of Teaching in Physical Education, 24,* 265–281.

McKenzie, T.L., Catellier, D.J., Conway, T., Lytle, L.A., Grieser, M., Webber, L.A., . . . Elder, J.P. (2006). Girls' activity levels and lesson contexts in middle school PE: TAAG baseline. *Medicine and Science in Sports and Exercise, 38*(7), 1229–1235. PubMed doi:10.1249/01.mss.0000227307.34149.f3

McKenzie, T.L., Marshall, S., Sallis, J.F., & Conway, T.L. (2000). Student activity levels, lesson contexts, and teacher behavior during middle school physical education. *Research Quarterly for Exercise and Sport, 71,* 249–259. PubMed doi:10.1080/02701367.2000.10608905

McKenzie, T.L., Prochaska, J.J., Sallis, J.F., & LaMaster, K.J. (2004). Coeducational and single-sex physical education in middle schools: Impact on physical activity. *Research Quarterly for Exercise and Sport, 75,* 446–449. PubMed doi:10.1080/02701367.2004.10609179

Motl, R.W. (2007). Chapter 2: Theoretical models for understanding physical activity behavior among children and adolescents: Social cognitive theory and self-determination theory. *Journal of Teaching in Physical Education, 26*, 350–357.

Pedometer Reviews. How does a pedometer work? Retrieved May 25, 2013, from http://www.pedometer-review.com/about-pedometer/how-does-a-pedometer-work.htm

Reid, G., Bouffard, M., & MacDonald, C. (2012). Creating evidence-based research in adapted physical activity. *Adapted Physical Activity Quarterly, 29*(2), 115–131. PubMed

Roberts, V., Maddison, R., Magnusson, J., & Prapavessis, H. (2010). Adolescent physical activity: Does implementation intention have a role? *Journal of Physical Activity and Health, 7,* 497–507. PubMed

Scruggs, P.W. (2007a). Middle school physical education physical activity: A pedometer steps/min guideline. *Research Quarterly for Exercise and Sport, 78*(4), 284–292.

Scruggs, P.W. (2007b). Quantifying activity time via pedometry in fifth- and six-grade physical education. *Journal of Physical Activity & Health, 4,* 215–227.

Silverman, S. (1994). Research on teaching and student achievement. *Sport Science Review, 3,* 83–90.

Silverman, S., & Solmon, M. (1998). The unit of analysis in field research: Issues and approaches to design and data analysis. *Journal of Teaching in Physical Education, 17,* 270–284.

Silverman, S., Tyson, L., & Krampitz, J. (1992). Teacher feedback and achievement in physical education: Interaction with student practice. *Teaching and Teacher Education, 8*(4), 333–344. doi:10.1016/0742-051X(92)90060-G

Sit, C.H.P., McKenzie, T.L., Lian, J.M.G., & McManus, A. (2008). Activity levels during physical education and recess in two special schools for children with mild intellectual disabilities. *Adapted Physical Activity Quarterly, 25,* 247–259. PubMed

Solmon, M.A. (2003). Student issues in physical education classes: attitudes, cognition, and motivation. In S.J. Silverman & C.D. Ennis (Eds.), *Student learning physical education: Applying research to enhance instruction* (pp. 147–163). Champaign, IL: Human Kinetics.

Solmon, M.A., & Lee, A.M. (1996). Entry characteristics, practice variables, and cognition: Student mediation of instruction. *Journal of Teaching in Physical Education, 15,* 136–150.

Spence, J.C., Blanchard, C.M., Clark, M., Plotnikoff, R.C., Storey, K.E., & McCargar, L. (2010). The role of self-efficacy in explaining gender differences in physical activity among adolescents: A multilevel analysis. *Journal of Physical Activity and Health, 7,* 176–183. PubMed

StataCorp. (2011). *Stata Statistical Software: Release 12*. College Station, TX: StataCorp LP.

Supaporn, S., Dodds, P., & Griffin, L. (2003). An ecological analysis of middle school misbehavior through student and teacher perspectives. *Journal of Teaching in Physical Education, 22,* 328–349.

van der Ploeg, H.P., van der Beek, A.J., van der Woude, L.H.V., & van Mechelen, W. (2004). Physical activity for people with a disability: A conceptual model. *Sports Medicine (Auckland, N.Z.), 34*(10), 639–649. PubMed doi:10.2165/00007256-200434100-00002

Vincent, S.D., & Pangrazi, R.P. (2002). Does reactivity exist in children when measuring activity levels with pedometers? *Pediatric and Exercise Science, 14*, 56–63.

Vincent, S.D., & Sidman, C.L. (2003). Determining measurement error in digital pedometers. *Measurement in Physical Education and Exercise Science, 7,* 19–24 10.1207/S15327841MPEE0701_2. doi:10.1207/S15327841MPEE0701_2

Yun, J., & Ulrich, D.A. (2002). Estimating measurement validity: A Tutorial. *Adapted Physical Activity Quarterly, 19,* 32–47.