

# Diffusion of Innovations and Program Implementation in Areas of Health Behavior/Education/Promotion, Physical Activity, and Physical Education

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## Abstract

Diffusion of Innovations (DOI) is a complex and intricate theory applied in a variety of contexts. This review investigates the five key attributes of innovation in DOI (relative advantage, compatibility, complexity, trialability, and observability), as well as the stages of diffusion within innovators (early adopters, early majority, late majority, and laggards). Literature is examined with the application of DOI in areas of general education, health behavior/education/promotion, physical activity, and physical education. The model lends itself well to be applied within the physical education realm, but at this point is an understudied theory within the context.

Keywords: Diffusion of Innovations (DOI), dissemination, program implementation, physical education

## Introduction

Researchers use a variety of frameworks and models throughout their studies. As physical education (PE) researchers, it is common to borrow models from other areas of research and apply them to our field. This holds true for the Diffusion of Innovations (DOI) Model. The model was initially used in fields such as anthropology, sociology, marketing, business, engineering, communication, geography, and technology (Rogers, 2003; Greenhalgh, Robert, MacFarlane, Bate & Kyriakidou, 2004). Over time, the science of dissemination has allowed the concepts to roll over into other fields such as public health, health services, criminal justice, social work, forestry and fisheries, and most importantly for the conclusions of this paper, education (Dearing, 2009). The notions of adoption and diffusion, two key components of the model, are highly relatable to other terms used within the PE setting such as program implementation and dissemination. This is how the model has been appearing in literature in education, health science and behavior, physical activity (PA), and PE.

PE's a prime area to apply the DOI model because of the

various new initiatives (Ross, 2013), teaching methods (Corbin & Cardinal, 2008; Haslam, 2009; Lulescu, 2017) and resources that are constantly being developed and explored (Devecioglu, Sahan, Tekin, & Yildiz, 2012). These innovations are increasingly relevant to the PE profession as well as our country's collective health, due primarily to the growing importance of fighting the obesity epidemic and promoting lifelong PA for all students (Centers for Disease Control and Prevention [CDC], 2015). As researchers and practitioners develop creative new ways to teach, or design new activities and equipment for students to reduce childhood obesity, it is necessary to have a better understanding of how these innovations will be consumed by the very people that they are being designed for – physical education teachers (PETs).

Throughout the history of PE, there have been an array of innovative ideas implemented inside the gymnasium, that have eventually disseminated outside the school walls. Two prime examples of innovations that have been introduced to PE over the last few decades consist of: (1) pedometers, and (2) heart rate monitors. Pedometers were once seen as the silver bullet to increase PA in PE through claims made in research that it was a valid tool of assessment, accountability, and measurement of PA (Bassett & Strath, 2002; Clemes & Biddle, 2013). The innovation of pedometer usage even extended to families in the home, outside of the PE environment (Rooney, Gritt, Havens, Mathiason, & Clough, 2005). A similar trend occurred with heartrate monitors. Heart rate monitors were also proven through research as a valid and reliable measure of PA (Janz, 2002). The innovation of heart rate monitors also made an impact outside of the gymnasium, in athletic and sports contexts (O'Toole, Douglas, & Hiller, 1998). Theoretical frameworks can be utilized to understand the adoptions of such innovations. Among various existing models, DOI has caught the attention of professionals in our field with great potentials to facilitate our endeavors of improving student learning by creating new teaching methods and equipment, and even extending outside the gymnasium.

## What is the DOI Model? What does it look like in education?

The theory itself describes the adoption and diffusion of novel practices within a given social system (Rogers, 2003). Examples of this in PE include the incorporation of a nontraditional PA (e.g. self-defense, yoga, archery, and DrumFit), new teaching methodologies, integration of new equipment or facilities, and utilizing emerging forms of technology. The specific components of the DOI model that have the most interest for this review, along with the facets that relate most to the research fields discussed throughout the paper, consist of: the innovation and its five attributes, adoption process and stages, and diffusion and dissemination.

Innovation is an "idea, practice, or object perceived as new by an individual or other unit of adoption" (Rogers, 2003, p. 36). Within the model there are five key attributes associated with innovation:

(a) relative advantage, (b) compatibility, (c) complexity, (d) trialability, and (e) observability. Relative advantage has a direct correlation with whether or not adopters of the innovation persist (Greenhalgh et al., 2004). Adopters need to see if there is some benefit that will come of integrating the innovation. For a PET, this might mean incorporating an innovation such as a new piece of equipment, and as a byproduct their students' growth in learning is increased. The incorporation of this new equipment could support more practice time of motor skills, increase efficiency of movement, or make the content more relatable to students. Compatibility allows the adopter to interpret if the innovation aligns with their values, norms, and perceived needs (Greenhalgh et al., 2004). In PE, an example is to integrate a particular lesson activity that will enhance the learning of their students and fits within the already established standards and curriculum. Complexity refers to whether or not the innovation is easily adoptable. In a PE setting this could be an innovation such as technology (i.e. wearables, video instruction, virtual reality, augmented reality, gamification, or live streaming). Some deterrents might be if the technology is too difficult to figure out how to use for students or teachers, if it takes away from the content of the lesson, or if it is unreliable. Trialability is the notion that the innovation can be integrated gradually based on experimentation, rather than an immediate adoption (Webster et al., 2013). PETs may apply this notion by using an innovation for an instant activity, then gradually as a part of the lesson activities, and eventually basing the entire lesson on that innovation. A concrete example would be yoga. A PET starts his or her class with one or two yoga poses as a form of stretching after his or her students warm-up at the beginning of class. Next during a balance and flexibility unit the PET could put it as a station that students rotate to. Finally, the PET creates a small unit based on poses, flows, and different styles of yoga. Observability refers to the idea the innovation is visibly beneficial. For PE, this could be as broad as noticing a much higher rate of student engagement in the gymnasium for the innovation of a technological resource.

For the purpose of this model, Rogers (2003) defines adoption as a "decision to make full use of an innovation as the best course of action available" (p. 21). There are many factors that can influence the process of adoption for individuals or groups such as population status (level of privilege), socioeconomic status, position within a network or system (administrator, novice teacher, veteran teacher), personal characteristics (motivation level, belief system), and environmental context (geographical setting, societal culture, or political conditions) (Wejnert, 2002). All of these facets then come into play during the five different stages of adoption: (1) innovators, (2) early adopters, (3) early majority, (4) late majority, and (5) laggards (Rogers, 2003).

Innovators are those that create the idea itself. Early adopters in PE are those who may go to a conference and learn about a novel activity. These PETs bring these ideas back to their own gymnasium and implement them. The early majority are those that then borrow the idea and integrate into their own teaching (fellow teachers in the building or district). Late majority are those who add it after the early adopters and early majority have been incorporating the innovation for a period of time. In this example these late majority could be the rest of the teachers in the district. The laggards are the individuals who were resistant to the innovation, but either now

see the benefit of the innovation or are forced by administration or peers to utilize it.

The DOI Process Model (Rogers, 2003) highlights the communication channels in which change occurs within a particular environment. This Process Model consists of five channels: (a) knowledge, (b) persuasion, (c) decision, (d) implementation, and (e) confirmation. It is imperative that researchers and practitioners understand and are knowledgeable of the decisionmaking characteristics at the very beginning of the innovation process. For example, characteristics such as socioeconomic status, personality traits, and communication behavior are essential functions that practitioners and researchers need to be made aware of before implementing their innovation. The persuasion channel focuses on the strength of the innovation (i.e., compatible or complex). The more compatible the innovation, the more likely adoption of that new behavior will occur. Once this channel is navigated, then comes the decision-making process. If users choose to adopt the innovation, the implementation of that innovation continues. Lastly, if this innovation is successful, adopters will confirm its potential. Moving forward, adopters become users of the innovation.

In order to help readers fully understand the DOI model, it is important to address diffusion which is the "process by which an innovation is communicated through certain channels over time among members of a social system" (Rogers, 2003, p. 35). The concept of pure diffusion is when the spread of an innovation is unplanned and informal, whereas active dissemination is the opposite, where the spread of innovation is done through a hierarchy in a planned, formal fashion (Greenhalgh, 2004). Both extremes are present in PE. On one end an individual teacher may come up with an idea in a gymnasium as an individual, and eventually spans to other PE teachers in the building, or even across an entire district happening authentically. At the opposite end of the spectrum other innovations discovered by administrators are mandated to be distributed as a requirement in all gymnasiums throughout the district. These two examples represent each end of a continuum or spectrum of DOI, and can initiate a wide range of modes of diffusion. Within PE, as well as the health arena, other terminology can be associated with diffusion, such as 'program implementation' or 'dissemination.'

### Purpose

The purpose of this literature review is to provide an understanding and description of the DOI model as it relates to the fields of health and PE. The secondary purpose of this article is to suggest that an understanding of the DOI model can possibly help PETs and peripheral stakeholders to improve the way innovations are implemented. Given most if not all innovations in PE are for the benefit of all students and their health, it makes sense that we need to understand how various teachers think about and participate in the process of implementation. Successful implementation of the DOI model to PE initiatives, would mean that stakeholders are more aware of the complex social, cultural, and personal factors that are involved. The review of current literature is meant to be an example, foundation, and reference point for future utilization within PE research.

Specifically, through this examination the researchers provide an explanation of current literature that exists around the DOI

model within the health and PE realm. The focus of the paper is related to the concepts of the DOI model that have been applied to the dissemination of particular programs, curriculum, or strategies within the aforementioned field. These articles provide specific examples of how DOI can be integrated within health behavior/education/promotion, PA, and PE contexts. The intent of the article is to highlight the necessity for this model within PE, since there will always be new innovations within teaching methodologies, curriculum and strategies. This model has the potential to provide an understanding of variables associated with why a PET may be in a particular level of adoption. As a result from findings such as what causes specific personalities or teaching identities to remain or change their levels of adoption, these can inform processes for future diffusions of innovations, and how to target those individuals. Along with understanding teaching identities and personalities that may align with specific stages of adoption, researchers, administrators, and practitioners alike, should know the five attributes of DOI, which could increase the likelihood of effectiveness with the implementation of new innovations. It is hoped that the literature review would shed new light on providing forms of support and guidance through this process.

### Method

The initial intent of the DOI theory was not directed towards such fields as health or PE, but its application has been successful and useful for many researchers. While the use of the model may be fairly new to these areas, there are examples of when applying the model, there were clear results as to what was ineffective or, on the other hand, successful within the process of disseminating innovations within the literature. Starting with an overarching umbrella of education, the review of literature will work through examples of the model or similar concepts, and how it has been analyzed or applied, with the focus becoming narrower as the literature works through health behavior/education/promotion, PA, and culminating with PE.

### Inclusion/Exclusion Criteria

The articles used for this review were published between the years of 2000-2017. There was an emphasis to utilize empirical work throughout the paper instead of opinion or editorial articles. During an initial search, the databases Web of Science and PsychInfo were used. The keywords diffusion of innovations AND education were put into the search engine. This search yielded a total of 40 articles. A majority of these articles did not actually investigate DOI or education. Emphasis was placed on articles that explored the dissemination of programs within the health and PE fields. The initial intent was to examine what types of systematic approaches to disseminating innovative programs or strategies were successful. These articles were also more editorial or opinionated in nature. Due to the misalignment of the search results and lack of empirical work, the search was expanded.

### Expansion of Search

While looking for articles, the reference sections for the articles yielded in the initial search results were examined to find potential articles. By investigating those articles, a snowball effect was utilized to find the remainder of the articles capitalized in this

review. While reading through the articles, it was also noticed that within the fields of interest (e.g., education, health behavior and education, PA, and PE) other terminology were used in place of DOI, such as program implementation or dissemination. Although some of the studies did not use the actual model of DOI, some of the foundational notions were still present and therefore included in this review.

### Results

The results section analyzes current literature on DOI from a broader educational context, within health behavior/education/promotion, PA, and PE. The intent is to provide an initial, overarching perspective of DOI from a wider lens as it applies to a general education setting, then navigate a narrower focus as DOI relates to content areas more specific to the field in arenas of health, PA, and PE.

### General Educational Setting

Dissemination of curriculum throughout a variety of educational settings can be challenging. From a broad educational perspective, there are multiple barriers to full diffusion of curriculum such as involvement of, and relationships between, many stakeholders (national and state representatives, district office members, building administrators, staff members, teachers, parents, and students), policies (national, state, local), and environmental context (socioeconomic status, resources available, financial supports) (Craig, 2006). Kealey, Peterson, Gaul, and Dinh (2000) examined the role of teacher behavior within the implementation of curricular change. These authors found there can be multiple obstacles within teacher behavior such as the motivation to teach particular topics, lack of knowledge of their role within the implementation process, and insufficient knowledge or confidence with the innovation process.

While there are roadblocks to success, there are also structural aspects that support the diffusion of curriculum. Payne, Gottfredson, and Gottfredson (2006) found a solid program development process, principal support, standardization of curriculum, and organizational capacity to be pillars of achievement in the diffusion of curriculum. From the standardization aspect, providing teachers with a curriculum that has clear, explicit directions, and materials already organized for them are identified to be a facilitators of dissemination. Playing into Rogers (2003) factor of complexity in the innovation attributes, it was also seen that if the program can be integrated into an already existing normal school day activity, the program was more likely to be successful. Beets et al. (2008) discovered positive teacher attitude and beliefs of the school climate was a large indicator of successful diffusion of curriculum. These authors showed classroom and school-wide material availability and usage, strong administrative support, and a climate of cohesiveness and shared visions were the largest indicators of a positive concept of school climate with regard to program implementation. Not only is DOI practical in the educational setting in a broad sense, but it has also been found to be an applicable theory within the health field.

### Health Behavior, Health Education, and Health Promotion

**Health Behavior promotion.** The fields of health behavior and health education have some overlap with the findings regarding the broad arena of education. However, there are also some characteristics that make this market of individuals and groups unique. Oldenburg and Glanz (2008) pointed out some differences between workplaces, schools, and health care settings with regard to the diffusion of health behaviors. These authors spoke to dissemination in a smaller capacity where the emphasis may need to be on introduction of a specific service, changes in policies or regulations, or adaptations to particular roles of personnel. Applying this as a communitywide approach, importance should be put on communication through grander modes of media, government level policies, and coordination of multiple individuals or even groups. The application of these notions, along with other findings, was shown in a particular study in the realm of health behavior. In the study titled the *Pool Cool Skin Cancer Prevention Program*, Glanz, Steffen, Elliot, and O’Riordan (2005) found there was a specified timeframe that was critical between distribution of information and implementation of the program. These authors also showed results in a large study with regard to mass communication. The last major takeaway was to continue to modify the program as barriers begin to surface.

**Health Education.** Health education becomes a blend of educational philosophy along with health behavior concepts. Godwin and Heymann (2015) made a plea that public health leaders need to be trained in order to provide students the ability to have agency in the health field with regard to concepts that require societal change, along with the capability to be critical of social, economic, and environmental health issues as a part of a global community. They suggested creating ways to bring together collaborative classes from different communities and countries in an attempt to solve this problem. This health education approach could be adapted through DOI communication channels. For example, creating an innovation, such as adding nutritional information/labels to cafeteria food, and developing positive student attitudes towards this innovation would align perfectly with the Knowledge and Persuasion components of the Innovation Decision Process Model.

While the study did not focus on collaborative classrooms, Ball, Ogletree, Assunda, Miller, and Jurkowski (2014) investigated the concept of distance education within the field of health, which could be a step in that direction. Distance education refers to utilizing technology so students can take coursework online and not be physically present in a classroom in order to achieve his or her education. Using the Implementation and Confirmation communication channels of the Innovation-Decision Process Model, Ball and colleagues (2014) attempted to examine the possibility of providing health education at a distance at the collegiate level. Their findings suggested professors diffusion of distance health education was mostly dependent on communication channels (what modes of technology were used to disseminate curriculum and communicate with students), and characteristics of the innovations (i.e. increased distance education would make them more competitive in the collegiate arena, provide more students with the opportunity for health education, difficulty to use instructional strategies within the course, etc.). With an ever

changing society, and an increase in the use of technology, it is important to reflect on how the use of distance education could potentially impact PE. Online learning is becoming increasingly popular at the k-12 and collegiate levels. This study has the possibility of providing information on how to apply the DOI model when implementing such programs within a PE context.

**Health Promotion.** There is a strong push for innovation within the realms of health promotion and education. Deschnes, Trudeau, and Kebe (2009) studied how dissemination of an innovative health-promoting program in an educational setting may or may not be plausible. These authors explored the use, and validity of, a survey measuring health promotion within the school system with regard to the DOI model. Through proving the validity of the psychometric properties of the survey, findings showed early predictors of adoption of the health promoting school approach included contextual barriers (difficulty of implementing the program), anticipated benefits (perception of promoting positive healthy behaviors in students), and collective efficacy (members of the schools setting have the knowledge to implement such a system).

Another study dealing with health promotion in education was conducted by Rogers and Motyka (2009) and examined the feasibility of schools adopting and delivering a healthy messaging system throughout the school day. Teachers reported the messaging system was easy to use in conjunction with the provided resource kit, which relates back to Rogers (2003) innovations attributes of complexity and compatibility. Perceived complexity and compatibility of this technological innovation helped the teachers understand the importance of schoolwide messaging, and led them to the decision stage whether or not they wanted to adopt this as the new norm. Administrators stated they saw the project to be worthwhile for their staff and students, which confirmed the innovation’s attributes of observability and relative advantage. Through DOI, administrators were able to observe the positive impact of the messaging system with increase of awareness of communication in the school community. The students had a positive response, and teachers reported that they would continue to implement the system.

### Health Promotion and Physical Activity within Schools

Just as Godwin and Heymann (2015) made a plea for health promotion within education, so did Owen, Glanz, Sallis, and Kedler (2006) with respect to PA interventions in education. These authors entertained the notion there are many options for evidence-based PA interventions, and with that in mind, there is a need for widespread diffusion of such programs within the school setting. They continued to claim for a need to collaborate with policy experts from other areas of research to improve an interdisciplinary science-based form of dissemination and diffusion.

As the DOI model becomes more well known within health behavior, education, and promotion, along with the shift in PE to a health promotion based model (IOM, 2013), there is overlap in the research between health promotion and PA within the school setting. Through two widely known health promotion models, Child and Adolescent Trial for Cardiovascular Health (CATCH) (McKenzie et al., 1996) and Comprehensive School Physical Activity Program (CSPAP) (CDC, 2015), the connection between

PA and health promotion is investigated through the lens of diffusion of innovative ideas within that context. For example, PE teachers can develop ways to increase PA during school – one of the CSPAP components. Once they develop their PA intervention (i.e., PA in the classroom), they can begin to promote and commercialize their intervention with teachers, administrators, and students (CDC, 2013; Karp, Scruggs, Brown, & Kelder, 2014). After the PA intervention becomes commercialized, the diffusion and adoption process begins. Classroom teachers will start to incorporate PA in their classrooms and choose whether or not they want to move forward with this new innovation.

With regard to the CATCH model, it was found that such a system can be maintained over a long period of time (Hoelscher et al., 2004). The training of the teachers had the largest impact on the success and maintenance of the program. It was also found that school climate was associated with continued implementation of CATCH (Parcel et al., 2003). With respect to the CSPAP model, it was discovered that communication with other stakeholders such as family, community, and staff members in the building was important in program implementation (Glowacki, Centeio, Dongen, Carson, & Castelli, 2015). Educating those that are situated in and outside of the school setting goes hand in hand with the Knowledge and Persuasion channels of the DOI-Decision Process Model. Similar findings by Carson, Castelli, Beighle, and Erwin (2014) displayed the necessity for interaction and communication between stakeholders, as well as certain elements of the model. These authors concluded the CSPAP components, facilitators, leaders, and culture all need to interact in unison on the micro and macro levels for the implementation of the program to be successful. The CSPAP implementation factors mentioned above would be considered innovative characteristics based on the innovation-decision process. DOI such as the compatibility and trialability of the CSPAP framework may affect micro and macro levels of implementation.

Beyond those two models, Faber, Kulinna and Darst (2007) suggested ways to promote healthy behaviors in schools through a variety of program implementations. Some of these included providing students with age-appropriate playground equipment and space, before/after school programming, promotions and announcements about opportunities in the community, family nights, and healthy food services. All in all, as PA and public health researchers identify problems, such as preventable and treatable chronic diseases due to a lack of PA, they may seek to develop and design new frameworks or activities (i.e., innovation) that help teachers increase student PA opportunities throughout and beyond the school day. Thus, utilizing the Knowledge and Persuasion components of the DOI framework as a means to incorporate more PA before, during, and after school may help researchers reduce sedentary behaviors in and outside of the classroom.

### **Physical Activity within the Classroom**

**Preservice Elementary Education Teachers.** Since PE has been transitioning from a traditional sports style to a health promotion approach (IOM, 2013), the involvement of classroom teachers has become an integral part of the overall model. The training for the diffusion of PA throughout the school day started with general education preservice teachers. There were a few studies

regarding the attitudes, perceptions, competence, and potential barriers preservice classroom teachers may have with regard to the integration of the promotion of PA within their classroom and school as a whole (Webster, 2011; Webster, Erwin, & Parks, 2013; Webster, Monsma, & Erwin, 2010). The promotion of PA was seen as the innovation within these contexts. The beliefs about the innovation and perceived barriers were found to impact the level of adoption. These studies showed perceived barriers (i.e. adapting movement to fit classroom lessons), previous PE experiences, competence with how to integrate movement, and their own attitude toward sport participation or PA all had an impact on the success or challenge of implementing PA within the classroom and school setting for preservice classroom teachers. Through the lens of DOI, the perceived barriers found in these studies suggested there were compatibility issues present that hindered the level of diffusion of PA within the classroom.

**Classroom Teachers.** Due to a majority of the teachers already teaching in the school setting, studies were also conducted to investigate PA program implementation within preexisting classroom teacher settings. Hall, Liuttle, & Heidorn (2011) suggested that in order to prepare classroom teachers for this role, there needs to be clear communication about current research. These authors also believed there needed to be a capability to distinguish between PE and PA, a value for the role of the classroom teacher, an implementation of strategies for increasing PA, the ability to lead developmentally appropriate movement, an integration of PA into academics, participation in school programs outside of the classroom, and identification of benefits and being a role model. The Innovation Process Model can serve as an excellent outline for the adoption or rejection of an innovation in and outside of the classroom. The more knowledgeable the practitioner or researcher is of that environment and innovation, the more likely potential innovators will experience success, and ultimately adopt the new idea/practice. With these ideals in mind, other research examined barriers or facilitators to instilling some of these characteristics in classroom teachers. Webster and colleagues (2013) investigated the adoption of PA promotion within the context of a statewide policy. The findings indicated compatibility, simplicity, and observability from Rogers (2003) DOI model, along with domain-specific innovativeness predicated PA promotion in the academic classroom. Within the same context, Holt, Bartee, and Heelan (2013) showed classroom teachers' efforts to integrate PA in their classrooms was a significant contributor to the overall PA levels of children throughout the day. In this study, the implementation and confirmation stage of the Innovation Process Model were found to have increased PA during the school day. Classroom teachers made the conscious decision to adopt this new innovation and continue its adoption. As an overarching analysis, it was shown, however, that classroom teachers were only a piece of the puzzle, and in order to promote a comprehensive school PA program, there needed to be involvement from other stakeholders as well (Erwin, Fedewa, Beighle, & Ahn, 2012).

### **Physical Education**

The individuals truly in charge of innovation and diffusion of ideas for PA are the PETs (Carson, 2012). Yet, to the best of our knowledge, very little is known about PE teachers as seen through

the DOI model. Applying the model to gain a better understanding of the types of PE teachers that are most likely to lead or follow, will have great implications for successful implementations. Within the health promotion models, physical educators take on a role of leadership to support and lead others (community members, classroom teachers, parents, students, administrators, and other staff members) towards a more physically active, healthy lifestyle. Metzler, Lund, and Gurvitch (2008) worked through the different stages of a PET's career, and how that affected his or her ability, or rate of adoption of instructional innovation. As preservice teachers, their drive for innovation came from authority figures such as professors or cooperating teachers. Once they transitioned to a novice teacher, they were more likely to suppress their innovativeness and succumb to norms around them. After their fourth-year teaching, as they approached veteran teaching status, these authors suggested preservice teachers become better instructional planners, and their innovativeness varied widely across schools, departments, and individual teachers. Along these stages, there were many possible change agents that affected their ability to implement innovative instructional practices such as colleagues, higher academia, parents, administrators, workshop leaders, mentors, students, or themselves. There was also evidence of multiple barriers to program implementation within PE such as PE being a low priority in the educational system, large class sizes, and low academic value (Barroso, McCullum-Gomez, Hoelscher, Kelder, & Murray, 2005; Dwyer et al., 2003). Just as with the studies regarding PA implementation in the classroom, these barriers presented were in line with compatibility issues within the five factors of the DOI theory developed by Rogers (2003).

Along with the barriers presented above, there were other roadblocks, as well as facilitators, for program implementation in PE. Similar to the health promotion through PA programs, there were innovative programs within PE explicitly to support improvement of curriculum within the content area. An example of such a program was Middle School Physical Activity and Nutrition (M-SPAN) (McKenzie et al., 2004; Sallis, et al., 2003; Stone, McKenzie, Welk, & Booth, 1998). Findings from the implementation of this program showed a standardized curriculum increased PA in the PE setting; school environment and policy interventions had the potential to support dissemination of the program; the intervention was less successful for girls; and there were barriers to full implementation that need to be further explored (McKenzie et al., 2004; Sallis et al., 2003). The other program was Sports, Play, and Active Recreation for Kids (SPARK-PE) (Stone et al., 1998). This was the only pure standardized PE program implementation researched up until this point. Efforts were made to interpret the development, design, and dissemination of this national program. Findings indicated substantial collaboration among stakeholders was necessary, along with three key features of active curriculum, staff development, and follow-up support being available for the program to be effectively disseminated (McKenzie, Sallis, & Rosengard, 2009). This program was shown to be sustainable over a long period of time with the success being related to principal support, previously having a standardized PE program, and teachers being physically active (Dowda, Sallis, McKenzie, Rosengard, & Kohl, 2005).

## Discussion and Conclusion

The findings within the literature bring multiple facilitators and barriers to the forefront for the adoption and dissemination of a variety of curricular content, teaching strategies, and structural factors within related educational fields. There were ample studies providing evidence of the necessity to involve multiple stakeholders within the process of adoption and diffusion of such innovations. Another concept that continued to be present within the literature was the need for an awareness of the proper channels of communication in order for the dissemination of an innovation to be successful. Various studies suggested that DOI can be effective within the health and PE arenas, as long as there is an in-depth understanding of the individuals creating the innovation, the relationship to that innovation with those that are disseminating it, and the structure and communication channels surrounding the innovation, as they relate to the five attributes presented in Rogers (2003) DOI model.

While there is current literature that displays the use of the DOI model in different contexts, there is a lack of research utilizing DOI factors examining the dissemination and adoption of innovative curriculum and teaching strategies within PE. However, it is unclear why PE professionals have not used DOI to guide their innovative teaching in school-based PE. As the emergence of new technology continues, and the field battles the epidemic of childhood obesity, there is an urgent need for PE teachers to try new strategies to effectively promote physically active lifestyles among students. Future research on the topic warrants more attention of professionals in the fields of health and physical education.

It is encouraging that DOI helped professionals in other fields successfully implement innovations. Considering that PE is only different from other subject matters in terms of teaching content, there is untapped potential in researching and applying the DOI model within PE field. The components of the DOI model should be appropriate and relevant to the analysis of the dissemination of curriculum, along with other programs or models, within PE. However, it is important to note that the marginalization of PE may create more barriers for PE teachers to be innovative. As Beddoes, Prusak, and Hall (2014) pointed out, academic disciplines have had extensive changes in structure and content in response to standardized testing, national standards, and measurable outcomes. The authors also suggested that PE has made similar attempts, however "the mechanisms of marginalization of yesteryear continue today – perhaps, even, to a greater extent than ever" (p. 21). Barroso, McCullum-Gomez, and Hoelscher (2005) claimed that the marginal status of PE has presented numerous barriers (i.e. poor resources, demotion of subject matter, lack of professional development, etc.). These unique barriers in PE have the potential to make adoption and dissemination of innovative curriculum, methods, and strategies, that much more challenging in comparison to other content areas. Johns and Dimmock (1999) suggested a strategy to overcome marginalization would be "the adoption of a more integrated approach to the curriculum and a commitment to increase resource allocations," in turn impacting societal norms and values (p. 363). Future studies may need to explore if additional components should be added to the existing DOI model to make it better fit in PE.

Furthermore, professional learning experiences for PE teachers,

which would be likely places to encounter new innovations, have been found to be problematic in several ways (Armour, 2010; Hill, Beisiegel, & Jacob, 2013). Typical professional development (PD) for PE teachers has often consisted of one day events that are disconnected from teachers specific teaching contexts where practical application and adoption of new ideas is very unlikely (Patton & Parker, 2015). Complicating traditional PD for PE teachers with a DOI lens could lead to better innovation implementation by providing an ongoing support mechanism like a community of practice (Patton & Parker, 2017), that would provide a collaborative and supportive group to problem solve and think through barriers or roadblocks to innovations in PE. One specific support, the distinct role of the building principal, has been found to be instrumental in how PE teachers approach innovations within the context of their PD experiences (Betchel & O'Sullivan, 2006). Specific support and incentive mechanisms through professional learning experiences ought to be put in place before addressing innovations among PE teachers.

### Implication for Future Research on DOI in Physical Education

Future research needs to focus on the innovations within PE, and the five attributes that Rogers (2003) lays out for innovation (i.e., relative advantage, compatibility, complexity, trialability, and observability). These five attributes can help with identifying barriers for program implementation and create more discussion on how to better support teachers as their role as innovators. It is also important to place emphasis on the stages of adoption (innovators, early adopters, early majority, late majority, and laggards). Researching characteristics of individuals within each group could lead to information that would support more effective PD, dissemination procedures (formal vs. informal, timeline, etc.), and modification of the innovation to help all members have buy-in and support. As a concrete example for PD, research could investigate obtaining new innovations at conferences or conventions, and how that process of adoption is successful or not when implemented in their local teaching context. While there seems to be some work looking at the diffusion and dissemination of program ideas with regards to facilitators and barriers, there needs to be more research done within this context.

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