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# Project-based learning and its potential in physical education: an instructional model inquiry

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## ABSTRACT

Innovative Physical Education (PE) instructional and curriculum models have had a modest effect on PE programs in the United States (U.S.). In general, although several evidence-based models have been developed, there has been less adoption within schools. Notwithstanding, science, technology, engineering, arts, and math (STEAM) curriculum and Comprehensive School Physical Activity Programs (CSPAP) have proliferated in many US schools impacting most content areas, including PE. One instructional approach popular in modern education aligning with both programs, is Project-Based Learning (PBL). This article conceptualises current PBL characteristics and its potential in PE. Specifically, we explore how PBL has impacted student learning experiences and the limited research in PE thus far. PE teachers who implement PBL may simultaneously improve student learning and gain a seat at the table with other educational subjects by connecting with schoolwide initiatives. A call for more research on design and implementation of PBL in PE is provided.

## KEYWORDS

Project-based learning; physical education teachers; student motivation; student value

Despite the United States (U.S.) national physical education (PE) standards (SHAPE, 2014) and a strong history of PE curriculum and pedagogical scholarship (Chen & Garn, 2018; Ennis, 2017; Kirk, 2013; Metzler, 2011), innovation in the delivery of quality PE curriculum has been limited (Ennis, 2015; Hodges, Laughlin, & Brusseau, 2018; Layne, Chapatte-Ramos, & Irwin, 2016), often maintaining a traditional multi-activity sports program with a teacher-centered environment. Results are particularly poignant within secondary PE settings where students show a steady decline in PE attitude (Mercier, Donovan, Gibbone, & Rozga, 2017), physical activity (PA) behaviours (Yli-Piipari, Barkoukis, Jaakkola, & Liukkonen, 2013), and reduced motivation and perceived relevance in PE content (Webster, Mindrila, & Weaver, 2011). Importantly to note, there is also limited evidence of student learning and achievement in PE (Hastie, 2017). Some would argue that lack of evolution in PE is failing to keep up with current student needs, calling for the redesign of the curriculum (Ennis, 2014, 2015). With the push for lifelong learning and limited evidence in PE, there is need to advance the curriculum and instructional models delivered in PE to better meet the needs of current learners (Ennis, 2017).

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While the traditional methods of direct teaching often focus on memorisation and regurgitation, progressive models suggest a more active reciprocal style of teacher-student exchange of learning (Sun, Chen, Zhu, & Ennis, 2012). Although calls for innovative curriculum and instruction in PE have been abundant (Ennis, 2017; Kirk, 2013), instructors find direct instruction much easier to deliver and lack the commitment and/resources many instructional models require (Cardina & DeNysschen, 2018). Additionally, PE expectations have been highlighted to include priorities in knowledge and skills in lifetime activities (Ennis, 2015), social-emotional learning (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Hellison, 2011), and comprehensive school physical activity programs (CSPAP) and community PA partnerships (Carson & Webster, 2020). In a call to action for innovative curriculum, to better meet student needs, and to provide equal priority in social-cognitive learning in PE, one innovative curriculum model has been identified with potential, project-based learning (PBL; Bender, 2012; Thomas, 2000).

PBL has become widely accepted in mainstream K-12 education in the U.S. and has shown to be advantageous for student learning and engagement compared to traditional models (Bender, 2012; Thomas, 2000). As a result, advantages include having several school subjects such as math, science, and English, with overlapping curriculum and teaching structures when espousing PBL practices. Additionally, within the U.S., schools have begun adopting a Science, Technology, Engineering, and Math (STEM; U.S. Department of Education, n.d.) or more recently Science, Technology, Engineering, Arts, and Math (STEAM) curriculum (Hunter-Doniger & Sydow, 2016), which prioritises the PBL approach for implementation (National Research Council, 2014). Erwin (2017) suggested that the field of PE needs to consider embracing this innovation and incorporate PBL in the PE classroom. Recently, Treadwell (2018) suggested that STEAM, CSPAP, and PBL are interrelated and provide an ideal holistic learning opportunity for PE students. However, there is limited exploration and research into PBLs effect on student experiences in PE or, in general, as an innovative model within K-12 PE (see Coyne, Hollas, & Potter, 2016; Erwin, 2017; Gubacs, 2004; Hastie, Chen, & Guarion, 2017; Ramírez et al., 2017).

The purpose of this paper is elaborate on the characteristics of PBL and its potential in PE. First, we provide a summary of the PBL theory regarding major assumptions and previous findings. Next, given PBLs success in modern education we provide considerations for PBLs potential contribution to PE as a curricular partner within and alongside STEAM and CSPAP. We also provide a short review of the limited research on PBL in PE. Lastly, considerations for research on PBL and its potential impact on learning, motivation, and behaviour outcomes in PE, particularly at the secondary level, are provided.

## **Project-based learning: theoretical considerations**

The PBL instructional process is rooted in developing problems and training students on how to solve them. PBL curriculum development is based on values of constructivist theory which emphasise acquiring new and building on established knowledge structures necessary for a variety of tasks (Dewey, 1938). The principles of this learning theory include that, knowledge is constructed and continually built on previous knowledge

and experiences, students *learn how to learn* while engaged in learning the course content, students determine what new knowledge is required, and that learning is both active and social (Bender, 2012; Thomas, 2000). This means learning is not simply transmitted from teacher to student, but that students are required to seek out information and create connections to their personal lives (Savin-Baden & Wilkie, 2004). Also, PBL emphasises social constructivism which prioritises the collaborative process of learning, where learners interact and gain appreciation for differences within the group and rely on one another to construct their knowledge (Vygotsky, 1978). PBL theorists would argue that the constructivist approach of knowledge development via problem-solving is more meaningful to students who have learning barriers and/or who do not respond to direct instruction techniques (Thomas, 2000). Thus, PBL is an inquiry-based instructional model that emphasises a student-centered learning approach to reach real-world solutions (Buck Institute of Education [BIE], 2013). This approach is based on learning initiation, being that one has a problem that needs to be solved and must engage in discovery to create solutions. For over 20 years, researchers have made the argument that twenty-first century learners needed to experience real problems and use inquiry to guide solutions in order to maintain motivation in education settings (Bell, 2010; Duch, Allen, & White, 1998). These processes of learning align with internal basic instincts of students. In recent years, PBL has shown to enhance student learning as opposed to traditional teaching styles, improve attitudes towards learning (Thomas, 2000), and foster student collaboration, relevance, and motivation (Younker & Bracken, 2015).

Medical school instructors are often credited with the conception of PBL (Barrows, 1985). PBL relies on twenty-first century learning needs, or the four C's, to ensure student learning: critical thinking, collaboration, communication, and creativity (Bell, 2010). The idea is focused on presenting small groups with real world cases (problems) to help students use their collective knowledge, communication, and resources to prescribe solutions (Duch et al., 1998). In summary, learners must assess their knowledge needs, be able to create solutions, build collaboration, and appreciate learning as a continuous process which is always evolving (Hmelo & Evensen, 2000). PBL curriculum posits that skills developed can be learned and applied further in a variety of situations. We will reference these skills as applied skills versus the popular term, *soft skills*. Students who have experienced PBL have demonstrated applied skills with great success which has increased situational interest in learning from elementary to secondary school (Bender, 2012; Hmelo & Evensen, 2000).

**Potential Disadvantages.** The template of PBL is drastically different from traditional curriculum delivery methods. Skepticism of PBL includes limited application in subject matter requiring specified answers (e.g. dates and names in History; Savin-Baden & Wilkie, 2004). In addition, notable perceived disadvantages include placing too much responsibility on students whose learning styles do not align, or, perennial freeloaders riding on the work of stronger students (Dart, 2009). In addition, the pre-planning time and commitment that teachers must engage in preparing for PBL units is substantially greater than traditional lesson by less planning procedures. Thus, those who prefer or are accustomed to a didactic approach to teaching are likely to be resistant this approach or view it as cumbersome (Dart, 2009). Lastly, students who have been trained to the methodical approaches of instruction may struggle

with this transition and often feel unclear about how to complete projects steps with less direct instruction.

**Project-, Problem-, or Case-Based Learning?** Although several ‘inquiry-based’ instructional style terms are used, there are slight differences, but overwhelming similarities (see Savery, 2006 for more details). Dewey (1938) extended the term ‘project-based’ in his work on constructivist learning to suggest that a series of non-linear steps may be needed to solve multiple problems combining several academic fields. In addition, PBL has become a blanket term that encompasses several inquiry-based teachings and learning strategies. The BIE (2013) states that PBL represents an overarching term for learning that consists of addressing multiple problems, collecting several data artifacts for evidence of learning, producing a tangible final object/presentation. and relying less on a single answer. This differs from case-base studies which are considered when using rich stories of depth and specificity to connect to a hypothetical scenario and specified contexts (Levin, 1995). In addition, the learning strategies via projects vs. problems is very similar and are often used in combination. However, suggested differences include that problem-based learning typically focuses on a single issue/subject or line of interest, tend to be shortened in investigative length, require more specified linear learning steps, use case studies as opposed ‘real-life’ connective scenarios, and do not require the creation of a product or performance like the project approach (BIE, 2013). The core concepts, teaching/learning techniques, real-world and dynamic applications, and project/presentation applications of ‘project’ learning seems to best align with PE as outlined below.

### ***PBL processes***

Content developed in PBL must meet two criteria: learners must perceive the tasks as meaningful and that the tasks/project meet an educational purpose (Larmer & Mergendoller, 2010). PBLWorks (pblworks.org; formerly known as BIE) provide essential project design elements for building a PBL project (See Table 1). Planning a PBL project can mimic unit development in PE utilising a backwards design approach (Lund & Tanneill, 2015) in which standards and previous knowledge of learners are identified in advance. Project goals are created by detecting the problems, challenges, and learning gaps identified in their students. Within PBL, special attention is given to students engaging in autonomous inquiry, reflection, critique and in-group, out-group presentations. As an instructor, units must have systematic and intentional planning for these key PBL elements. These elements can look quite different from the direct instruction.

Lessons within PBL take on a more student-centered and learning process orientation (see Table 2 for generalised example). Daily lessons are driven by sequential inquiry where the learner is an explorer taking ownership in the scaffolded learning process. The instructor oversees the planning and provides background information to the learner, while the learning groups study the problem and evaluate possible solutions. In these settings, students are first taught to get to know one another before group learning begins (Hmelo & Evensen, 2000), similar to the Sport Education Model (Siedentop, Hastie, & van der Mars, 2020), Cooperative Learning Model (Dyson & Casey, 2012) and Teacher Personal and Social Responsibility Model (TPSR; Hellison, 2011). Classes initially comprise introductions to gain familiarity, creating rules, building a comfortable environment, and

**Table 1.** Gold standard PBL learning: seven essential project design elements.

Learning Goal Outcomes	<ul style="list-style-type: none"> <li>• Key Knowledge (Practical Information)</li> <li>• Understanding (Developing Competencies)</li> <li>• Success Skills (Application skills)</li> </ul>
Essential Elements	Definitions
A Challenging Problem or Question	The project is framed by a meaningful problem to be solved or a question to answer, at the appropriate levels of challenge
Sustained Inquiry	Students engage in a rigorous, extended process of posing questions, finding resources, and applying information
Authenticity	The project involves real-work context, tasks and tools, quality standards, or impact, or the project speaks to personal concerns, interests, and issues in the issues in the student's lives
Student Voice and Choice	Students make some decisions about the project, including how they work and what they create
Reflection	Students and teachers reflect on the learning, the effectiveness of their inquiry and project activities, the quality of student work, and obstacles that arise and strategies for overcoming them
Critique and Revision	Students give, receive and apply feedback to improve their processes and products
Public Product	Students make their project public by explaining, displaying and/or presenting it to audiences beyond the classroom

Note: Source= Buck Institute of Education (2013). For more information and resources regarding essential design components visit: <https://www.pblworks.org/what-is-pbl/gold-standard-project-design>.

developing affective goals within one's team. Groups build roles (e.g. leader, recorder) and together define the problems, hypotheses, and additional questions relating to the project. These teams will be responsible for using resources provided to them and distributing the work helping the group gain information (Bender, 2012). Instructors guide learning and develop open ended questions using inquiry (Leahy, O'Flynn, & Wright, 2013), similar to the Tactical Games Model (TGM; Mitchell, Oslin, & Griffin, 2013) or the Australian National Health and Physical Education (HPE; McCuaig, Quennerstedt, & Macdonald, 2013) curriculum. Many times, the inquiry does not possess any singular answer and students will be forced to revisit the hypothesis and data collection process again. Facilitators must negotiate with students on content by providing meaningful yet enjoyable learning experiences (Treadwell, 2018).

After members have contributed, students reconvene as a group to reflect on what they found which allows them to internalise the information and ownership in their learning. Students can be evaluated by instructors, peers, and themselves. PBL curriculum elicits authentic learning environments which increases the likelihood students can recall previously learned material (Savin-Baden & Wilkie, 2004). BIE (2013) and Hmelo and Evensen (2000) reiterate the importance of the reflection period following the lesson. When evaluating the benefits of PBL in several school subjects and the priority it places on twenty-first century skills, it seems imperative to evaluate the model as an innovative way to teach PE. The inquiry into PBL for the field of PE begins with learning what PBL may look like in PE, how it can impact student learning and motivation, and how adopting these methods may help facilitate continuous professional development for PE teachers.

## PBL connections to PE

Erwin (2017) and Treadwell (2018) suggests that in the changing world of education policy that PE teachers can contribute a major role to schools whose initiatives include adopting STEAM and/or CSPAP. Given how closely related many PBLs characteristics

**Table 2.** PBL daily lesson format example.

PE Lesson Structure	PBL Project Path	Routine Explanation	PE Example
Warm-up/ Instant Activity	Introducing/ exploring ideas.	Entering class event; Creating a need to know list	Students enter the class to their assigned team areas. They read the warm-up physical activity and also the cognitive warm-up questions; Create a need to know list for the day
Introduction to lesson	Generating questions for need to know list	Receiving guidance from teacher; complete need to know list; connect to previous lesson	Students complete warm up and meet teacher; Reflect on previous lesson and solutions. Finalise list of need to know questions for the day. List physical, cognitive, and affective skills to complete by the end of the lesson
Practice tasks	Build knowledge: Begin testing solutions and practicing them	Engage in reflection and application; Dig for other solutions; Collaborate	Students make a list of physical skills/ tactics, cognitive knowledge and affective needed for today's solutions. Students are tasks with physically participating in practices/ games/etc., while documenting areas of success/need
Practice/ Application tasks	Build Knowledge: Synthesise solutions and organise findings	Engage in the 4 C's: Critical thinking, collaboration, communication, & creativity	Students will pause physical performances to reflect on where they stand. They must synthesise their findings/ experiences and also reflect on their abilities within the 4 C's. Next, students will refine and extend skills guided by their own reflection and teacher's guidance.
Group Meeting	Develop and Critique: Chalk Talk of findings	Sharing with group about what they found/think: What makes you say that?	All students report on collaborative and individual findings as it relates to answering the questions. Students provide peer feedback on skills as well as solutions, collaboration, and communication. Begin planning presentation to class
Presentation/ updates	I used to think ... Now I think (Presentation is used on final days of project)	Reflection on findings: What did I learn, how has my changing shifted.	Students present to class and reflect on overall problem and current step in project. What was learned, what did we think before we started, and what do we know now after trying it? Reflection on 4 C's of group to class.
Closure	Lesson closure	Teacher connects findings to project goals and provides feedback on student work.	Teacher performs a check for understanding. Connecting previous lessons to current lesson, and clues to the next lesson. Provides feedback about findings in all three learning domains.

Note. PBL lesson plan structures vary. See Buck Institute of Education (2013) on 'Project Path' designs (Unit Project Progressions).

are to other evidence-based PE instructional models (see Table 3 for examples; Metzler, 2011), adopting the PBL model may be comparable and potentially more plausible given the entire schools incentive to offer proper training, as opposed to specialised training/development only for PE or vice versa. For example, Ennis (2014) and Casey (2014) point out, innovative PE models like Sport Education, TGM, and TPSR are all considered student-centered instructional strategies that provide autonomy-supportive environments and prioritise all three learning domains as opposed to simply getting



**Table 3.** PBL characteristics and their overlap with other PE evidence-based curricular models.

PBL Characteristics	Sport Education Model	TGM	TPSR
<b>Group work, collaboration, Teamwork</b> (The Four C's)	<ul style="list-style-type: none"> <li>Teams (affiliation) are assigned roles and expectations for a season that guide day to day procedures</li> <li>Students facilitate roles and organise all games, practices, and activities directly</li> </ul>	<ul style="list-style-type: none"> <li>Students are placed into teams or partners and must facilitate small-sided game play on their own and perform a series of cooperative game learning in modified and exaggerated tasks</li> </ul>	<ul style="list-style-type: none"> <li>A central learning theme above skills and activity is demonstrating personal and social behaviours that are considerate of others and students learn from one another as opposed directly from teacher</li> </ul>
<b>Using inquiry as an instructional tool</b> (Higher-order thinking)	<ul style="list-style-type: none"> <li>Provided game scenarios used to elicit team tactics and preparations for executing effective strategies</li> <li>Inquiry used for learning team roles (i.e. how to officiate)</li> </ul>	<ul style="list-style-type: none"> <li>Predominant instruction takes place using questions as instruction; each lesson targets tactical decision making facilitated by teacher</li> </ul>	<ul style="list-style-type: none"> <li>Questions guide discussion on feelings, actions, and reflections on positive examples and how to correct negative behaviours</li> </ul>
<b>Student voice, choice, and reflection</b> (Student-centered environment)	<ul style="list-style-type: none"> <li>Provided opportunities to select from an array of practices tasks (autonomy supportive teaching)</li> <li>Vote on game rules &amp; conflict resolution (Sport committees)</li> <li>Share in planning of events</li> </ul>	<ul style="list-style-type: none"> <li>Provided opportunities to select from an array of practices tasks (autonomy supportive teaching)</li> <li>Peer and self – evaluation of behaviours, skill, and tactical execution regularly embedded</li> </ul>	<ul style="list-style-type: none"> <li>Embedded lesson structure events: relational time, awareness talks, group reflection time</li> <li>Array of equipment and achievement level choices for each task/activity</li> <li>Students taught how to express feelings; air grievances; make suggestions for lessons</li> </ul>
<b>Project outcomes, presentations, &amp; assessments</b> (Standards-Based Goals)	<ul style="list-style-type: none"> <li>Team learning portfolios, posters, practice sheets</li> <li>Team game and practice stats</li> <li>Season ending festivities and culminating activities</li> </ul>	<ul style="list-style-type: none"> <li>Evaluating tactical transfer using journals and presentations</li> <li>PSR evaluations for small-sided game coordination</li> <li>Role play, peer teaching, and application journals</li> </ul>	<ul style="list-style-type: none"> <li>Group/partner creation of PSR scenarios and behaviour protocols</li> <li>PSR transfer portfolios/artifacts</li> <li>PSR checklists/teacher observations</li> </ul>

Note: PBL: Project-based learning; TGM: Tactical Games Model; TPSR: Teaching Personal and Social Responsibility Model.

students physically active. However, teachers offering these models may not receive enough professional development support and teachers who experience *one-off* trainings are less likely to adopt change. As importantly, PE teachers housed in schools that prioritise STEAM may demonstrate their academic importance and vital role of PE in students' holistic learning experiences by adopting PBL as well (Treadwell, 2018). In other words, creating cohesion with other school subjects by using similar practices may provide PE a spot at the larger academic table. These changes to PE may help teachers gain an increased sense of mattering and reduce feelings of marginalisation in schools leading to increased job satisfaction and quality learning experiences for students (Richards, Gaudreault, Starck, & Mays, 2018). In summary, PE teachers may be able to



boost their status in schools if they are seen as teacher's first, operating in the same curricular and instruction confines as the teachers of other subjects. Also, PE teacher's who lament on the lack of 'PE-specific' training is likely to feel more supported and engaged in school-sponsored continued learning that targets PBL if they too are utilising its features. This may lead to improving PE's status in schools via improved perceptions by colleagues and students and garner equal footing as other school subjects.

Practitioner guides for implementing PBL and embracing teaching strategies have become more recently available (see Coyne et al., 2016; Erwin, 2017; Treadwell, 2018). Coyne et al. (2016) provides a step by step process for implementing PBL within PE. Authors describe six key steps including: (1) determine your educational goal; (2) plan your driving question; (3) ready, set, go! Implement the PBL project; (4) Encourage peer-to-peer feedback; (5) Assessment is key; (6) take the time to reflect and celebrate. Although the purpose of this paper is not to provide a concrete curriculum using PBL at this time, we do feel a brief example may spark interest in the topic. For example, a PE teacher may pose a unit/semester/program scenario such as,

Our community has shown a dramatic decrease in overall health and physical activity behaviors in recent years. Students from middle school to college have been increasingly less active and this has increased physical and mental health problems for them. Our problem is this, what can we do to reduce the trend of less activity and increased sedentary time in our community? What knowledge, skills, opportunities, and behaviors may help solve this problem? Let's start with what we currently know and think about things we need to know more about. Go!

This scenario could spark a variety of answers in each of the three learning domains including *cognitive* such as, what does our community offer for activity experiences, what do we need to know about good physical and mental health, why do people do less activity as they get older, and/or why do people not enjoy activity? The *affective* domain can be captured with questions like, what are social-emotional benefits of being active? What personal and social skills are needed to play in recreation leagues and health/wellness centres? And a daily focus on the *psychomotor* domain would be required to address questions like, what skills are needed to active in fitness/sport/lifetime activities and how do you do them? What are the proper skills for safe weightlifting, can I do them? Answers could potentially lead to responses such as, we need to know more about our physical fitness, our community opportunities like soccer programs, frisbee golf, and cycling, in addition, we need to learn the skills and positions in these games. Also, we need to learn how to plan for regular PA and the types of skills necessary to get more people involved. Ultimately, each PE objective and standard provides evidence for what students know and can do. Similar to other inquiry models within PE, for every cognitive PBL goal would come its psychomotor counterpart in which students practice and develop skill/tactical competencies as well. This PBL example provides evidence and alignment to four contemporary innovations/calls to action in PE including:

- Incorporating CSPAP goals, student projects can incorporate outside of PE activity time and community partners (Carson & Webster, 2020), students may engage in an end of unit presentation like a health and PA fair, recess sport tournament design, or community health project (Treadwell, 2018).

- Reconnecting PE with health and embracing a Health and Physical Education (HPE) focus (Ward & Cho, 2020). Connecting HPE to student wellness and holistic learning, particularly at the secondary level has been adopted by many states in the U.S., and national curriculum's as in Australia (McCuaig et al., 2013). HPE then represents an experiential learning course focused on knowledge of health, PE, and well-being connect to the life context.
- One potential benefit of PBL and connecting experiences to students may be an increase in value for the information. PE research has shown that students may not connect PE experiences or content to their life (Ennis, 2015), and are less likely to find value and relevance with the material, particularly at the secondary level (Simonton & Garn, 2019; Webster et al., 2011).
- Special consideration of social interactions between teachers and students is a critical component which can increase positive affective experiences and connection to class material (Coyne et al., 2016; Simonton & Garn, 2019; Sun et al., 2012). Teachers may use relevant PE-related problems that promote enjoyment in these settings. These formal and informal positive interactions are likely to prompt similar behaviours to outside of PE opportunities (Simonton & Garn, 2019).

The innate value of PE has many layers for instructor's and hopefully students. For example, meeting PA levels has continued to be troublesome with a decline in amount of time allocated to PE (Ennis, 2014). While most students may not reach recommended PA levels, others believe the cognitive knowledge acquired about activity experiences are equally essential to healthy lifestyle choices (Chen, Chen, Sun, & Zhu, 2013; Hastie et al., 2017). Although there is importance to obtaining appropriate PA levels for all students, it could be argued that students need advanced content delivery in class to adequately cultivate skills, habits, and attitudes that influence an active life (Chen et al., 2013; Ennis, 2017). In addition, some PE specialists may push back on PBL delivery for a variety of reasons including perceptions of less PA time during class, emphasis and priority being placed on the cognitive and affective goals, or those who disregard the importance of complexity, challenge, and cross-curricular design. However, these concerns are examples of limiting innovation and undermine the call to change the definition of PE, which should target improved learner outcomes and enhancing PE's place in schools (Ennis, 2017). This resistance is nothing new to PE as those who have adopted cognitively-prioritised models (Ennis, 2014; Sun et al., 2012) such as Sport Education and TGM, or personal-social models (Hellison, 2011) have shown great strides in student learning in PE, reconceptualizing what goals of PE could and should be. Not only have these models been grounded in sound teaching-learning theory, they have shown to have positive impact on PA time in class and are more strongly linked to impacting student behaviours outside of school as opposed to traditional teaching methods (Metzler, 2011).

PBL aligns with major theoretical pushes in proactive and preventative HPE learning styles as presented by the Australian HPE curriculum as well. McCuaig et al. (2013) posits that for the PE curriculum to develop knowledge, values, and beliefs in students that encourage the development of wellness and preventive health measures, a 'strengths-based' approach is warranted. Characteristics of this type of project align with PBL and include, (1) using inquiry pedagogies to enhance problem solving skills, (2) identify

resources that promote positive healthy living as opposed to health issues and deficits, (3) encouraging student voices within topics, resources, assessments and lived experiences. Overall, the approach of teacher's as change agents is far less effective than engaging students in a curriculum where they are the agent of change (McCuaig et al., 2013).

Identifying meaning in students' lives and solving problems with peers, related to PE content, may present a seismic shift in their perceptions of PE (Coyne et al., 2016). Ennis (2014) suggests that connecting meaningful content and the social environment in class to life outside of class can induce higher order thinking. STEAM and CSPAP programming align with these goals and are essentially set up to adopt a PBL format in class. PE knowledge and applicable skills are of great concern right now with high obesity and nutrition related illness in the U.S. (Centers for Disease Control and Prevention [CDC], 2014; SHAPE America, 2014). In addition, achievement in PE can be limited as teachers face marginalising barriers daily (Richards et al., 2018). Although more research is needed, PBL may aid increasing meaningful student experiences and in reducing barriers and feelings of teacher marginality as PE's curriculum would then be viewed alongside other academic subjects, asserting PE's spot at the table.

Lastly, incorporating PBL may provide greater potential for cross-curricular integration, which can help achieve school wide goals. Similar steps with PE-focused models like the Sport Education model (Siedentop et al., 2020) and the Science, PE, and Me! curriculum (Ennis, 2015) have attempted similar methods by including science, math, and history topics in a variety of PE units. PBL may help in reducing boundaries including removing traditional thoughts about what PE used to be to, what PE can provide current and future students. Using PBL is likely to incorporate multiple school subjects (e.g. math, science, technology) into PE, expanding PE's relevance (Coyne et al., 2016). Cross-curriculum integration in this format might provide a sense of connectedness between PE topics and everyday life, as opposed to seeing PE in a school-only silo, unconnected to life. The interpretation of the PE curriculum is quite broad (Dyson & Casey, 2012), suggestion PBL techniques have the flexibility to meet unique student needs.

### ***Alignment with National PE standards***

Traditionally, PE curriculum foci have been on skill development, particularly in sport-specific activities, however other PA outlets and lifetime activities other than sport are now regarded as essential for PE students as well (Lund & Tanneill, 2015). This variety of content is clearly represented in the U.S. nationally recommended standards. National standards were developed to increase accountability of the teachers, build competent students, and to increase best practices at developmentally appropriate levels (Lund & Tanneill, 2015). In combination, districts and teachers take the recommended standards and develop a curriculum representative of what students should know and be able to do throughout the grade levels.

According to SHAPE America (2014) physically educated students should represent all five standards; 1. Demonstrate competency in a variety of motor skills, 2. Applies knowledge of concepts related to movement performance, 3. Demonstrate knowledge and skill to maintain healthy amounts of PA, 4. Exhibits responsible personal and social behaviour that respects self and others, and 5. Recognises value of PE, enjoyment,

challenge, self-expression, and social interaction. It is clear when evaluating the standards that cognitive and social learning are prioritised to achieve a physically educated student. Also, it appears these learning domains may hold equal or more weight in predicting if students adopt an active and healthy lifestyle. The principles of PBL may allow teachers to mould curriculum to successfully meet all standards, while still developing students twenty-first century application skills. Specifically, the malleability of PBL allows teachers to not be siloed by a sport, concept, or skill. In fact, for students to complete projects, it would require them to constantly be connecting multiple content areas of PE (Coyne et al., 2016). PBL projects that align all learning domains may be most effective following procedures suggested by Hastie et al. (2017) and McCuaig et al. (2013).

### ***PE teacher considerations***

When considering PBL, an instructor's capability to develop appropriate problem scenarios will allow students to build physical, emotional, cognitive knowledge, while potentially providing more immediate relevance (Leahy et al., 2013). During group interactions and reflection, students will demonstrate and apply their new-found knowledge and skills specific to PE. Teachers must provide overt and intentional teaching of application skills like the four C's (Barrows, 1985; Hellison, 2011; Thomas, 2000). Using PBL, the teaching and learning processes within PE go well beyond simply placing students in activities to be physically active.

Additionally, the learning process in PBL also aligns with PE and innovative suggestions regarding standards-based assessment (Lund & Tanneill, 2015). In fact, Lund and Veal (2013) suggest projects as ideal performance-based assessments in PE. Projects allow students to demonstrate and apply knowledge using a host of artifacts that encompass all three learning domains and provide equitable emphasis to multiple standards and key outcomes. Application of knowledge can provide a more concrete and comprehensive approach to PE *which highlight conceptual change in expectations* of PE and physically educated students (Ennis, 2017). Projects used for assessments are touted for being complex and requiring higher levels of thinking (Lund & Veal, 2013), unlike many traditional forms of assessment in PE. Although traditional skills-based assessments can be used they should be viewed as supplemental to larger assessment goals of knowledge and application skills.

PE teachers who adopt PBL characteristics being embraced by their school may avow their role as an educator in the eyes of the school community. For example, the general teaching styles, day-to-day lessons, and cross-curricular integration will be a consistent for students in all subject courses. Again, these relationships may serve as a major advantage for PE teachers in schools. Several discrepancies between PE teachers experiences within school-wide professional development (PD) have been reported including limited time, resources, and having few opportunities of PE-specific training (Cardina & DeNysschen, 2018). In addition, PE teachers often report they experience less PE-specific PD and support from administrators (Norris, van der Mars, Kulinna, & Amrein-Beardsley, 2017a) and feel as if administrators do not possess the appropriate knowledge to provide quality evaluation of them (Norris et al., 2017b). Considering these marginalising and exclusionary practices, schools that adopt a PBL approach may be able to provide more meaningful PD experience for PE teachers. Although no

research on this currently exists it seems plausible that PE teachers may experience greater feelings of professional support and meaningful dialogue with administrations who opt for PBL modelling schoolwide.

### ***PBL implemented in PE***

While the authors are firm proponents of models-based instruction (Metzler, 2011), there is reason to believe that PBL may utilise key components from several models and be beneficial for students and teachers at schools who utilise the model. This may be particularly important as it pertains to CSPAP adoption with goals of connecting PE experiences to daily PA, schoolwide health, and community outreach (see Carson & Webster, 2019 for all key components). PE may possibly be the last chance for structured learning to take place before adulthood. In summation, the reduction in student motivation and value across the grade spans begs the question, what is worth student learning – sport and games, or application skills like problem solving and collaboration in a variety of PA settings, or both?

Student motivation and engagement in the PBL curriculum is impacted by task design and the utilisation of several instructional techniques including a student-centered focus, providing autonomy, small group learning, a mastery-focused environment, and selecting content of relevance and value to the students (Liu, Lou, Shih, Meng, & Lee, 2010; Simonton & Garn, 2019; Webster et al., 2011). Research regarding PBL in PE is very limited. Hastie et al. (2017) evaluated differences in student learning of health-related fitness (HRF) knowledge between students receiving PE instruction (Sport Education Model) and students learning using PBL. A group of 5th grade students completed an 18-lesson unit designed to deliver HRF concepts using PBL processes. The project utilised Larmer and Mergendoller's (2010) essential elements for design including:

- 1) a need to know, 2) a driving question, 3) student voice and choice, 4) 21st century skills,
- 5) inquiry and innovation, 6) feedback and revision, and 7) a public presentation.

Students designed HRF activities for their 'fitness trail' project in which they learned different HRF knowledge concepts and practiced their HRF skills each day. Over the semester they met PA goals and ended their project by reporting what they learned and used video presentations to show the fitness stations they created. Findings showed a significant difference in HRF knowledge at posttest with the PBL students scoring 18.5% higher than their counter parts. Moreover, researchers reported that PBL students showed higher levels of accountability and that the PBL unit provided more immediate personal relevancy to students.

Additionally, in Spain, researchers evaluated a PBL intervention of 6th grade students in a PA/PE program with a focus on development of personal values and skills such as effort, cooperation, and respect (Ramírez et al., 2017). Researchers reported pre/post intervention design which consisted of three consecutive PBL units across the school year. Although limited information on the PBL steps were provided, researchers reported use of student-centered, productive teaching styles. Students worked in small groups to solve content problems and had to present solutions via game/activity knowledge. Students were also expected to keep journals and conduct homework. Semi-structured interviews showed that students reported positively to having more accountability and

ownership in the learning process. Students reported higher scores in perceived responsibility, effort, and self-worth following the units. Teachers reported positive outcomes and stated their students took leadership and developed more respect when they oversaw equipment and their own projects. They felt PBL was more effective in teaching personal development values and skills than traditional methods. Lastly, teachers lamented that planning was difficult and took more time and managing students at different stages in the unit was challenging. However, teachers recognised that student's self-worth progressed positively across the school year. Ramírez et al. (2017) note that PBL disrupts traditionally teaching beliefs and habits which causes teachers to weigh the risks and question themselves which may make them less prone to adoption in some ways. Thus, more evaluation on PBLs impact and implementation in PE is needed.

### **Future research considerations**

Future research should consider implementing the PBL model in PE to understand its impact on student learning and motivation especially in schools who have adopted STEAM or CSPAP programs. This type of research would help identify possible achievement outcomes and advantages that PBL produces and solidify the model for adoption in PE. Given the assumptions of PBL and the goals of PE, this model may provide a balanced curriculum (physical, cognitive, and affective outcomes) that students can connect to their own lives. Potential research on PBL in PE is in its infancy and revolves around three general arenas: (1) PBL design, implementation, and PD for PE teachers, (2) PBLs impact on student learning and motivation, (3) PBLs impact on PE goals and student affect.

It is the opinion of the authors that PBL has the potential to be an effective curriculum format that can meet a variety of needs in PE including learning, motivation, and real-world skills for students. Much like other curriculum models with specified teaching behaviours and major assumptions, the PBL curriculum format should be followed explicitly to avoid a 'watered down' or 'cafeteria approach' where concepts are chosen and used at the interest of the teacher (Curtner-Smith, Hastie, & Kinchin, 2008). Researchers should consider findings in other subject areas regarding model fidelity and practice while incorporating PE-focused outcomes (Hastie et al., 2017; Ramírez et al., 2017). If PBL can produce student's with applicable skills for the real world, it's effective use in PE provides a strong argument for PE's relevance to the greater academic community. Apropos with giving PE teacher's training on PBL instructional skills, it appears work needs to be done in creating PE curriculum and lessons examples utilising the PBL format to share with practitioners. With limited examples in the field (Coyne et al., 2016; Erwin, 2017; Hastie et al., 2017), we would recommend similar procedures as other models like TPSR (Hellison, 2011), TGM (Mitchell et al., 2013), and Sport Education (Siedentop et al., 2020) to provide teachers with training resources, lesson structure details, and unit plan examples.

### **Conclusion**

PE must consider embracing innovative changes (Chen & Garn, 2018; Ennis, 2015) to fulfil the needs of twenty-first century learners, to maintain *a spot at the table* in the



general school education ethos, and to provide transfer of knowledge and skills for students from class to their lives. Although a variety of curriculum models have been introduced in PE to increase motivation and deliver instruction using best practices (Kirk, 2013; Metzler, 2011) innovation and achievement remains limited (Hodges et al., 2018; Layne et al., 2016). Within many U.S. schools PBL has largely been accepted as an effective teaching model (National Research Council, 2014) and encompasses several student-centered outcomes. PBL may be beneficial for student learning and motivation particularly for schools who have adopted STEAM or CSPAP programming. PBL development appears to align with other innovative models within PE and may help enhance student learning gaps within PE. However, continuous PD is needed for implementing innovative models like PBL. Considerations for use include a likely increase in school support and guidance from administration, however more research is needed. In summary, research on PBL in PE is warranted and may help address calls to action for meaningful and innovative curriculum in PE.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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