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# Moving from discussion to action: A formative research process to implement nature-based physical activities and support relatedness in physical and health education

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## Abstract

This is a second paper in a series outlining phases in a formative research process designed to develop, refine and use an action checklist that helped teachers utilize nature-based physical activity (NBPA) as a means of fostering relatedness for girls in Physical and Health Education (PHE). The first paper focused on the development of the checklist in order to help teachers utilize NBPA in their PHE classes (Gruno & Gibbons, 2021). This paper focuses on the second phase: the refinement, utilization, and results of the action checklists. Relatedness, drawn from the self-determination theory of motivation (Deci & Ryan, 1985; Ryan & Deci, 2000, 2020), provided the theoretical framework for the action checklist. In this paper, the authors describe the process and how the action checklists were used to help teachers utilize a wide range of NBPA curriculum actions and instructional strategies to address the motivational needs of girls in PHE. The authors include specific excerpts of teachers' use of the action checklists.



***Key words*:** formative research; self-determination; physical and health education; girls



## Résumé

Ce texte est le second d'une série portant sur les phases d'une recherche « formative » en éducation physique et santé. Cette seconde phase décrit le développement, le raffinement et l'utilisation d'une liste de vérification incitant les enseignants à insérer des activités de pleine nature orientées vers la relation chez des filles en éducation physique et santé. La relation, concept de la théorie de l'auto-détermination, a servi de cadre théorique à l'élaboration de la liste. Le texte décrit le processus et les actions des enseignants pour insérer dans leur enseignement un grand nombre d'activités de pleine nature. On y décrit également les stratégies d'enseignement pour entretenir la motivation des filles. Des extraits de texte écrits par des enseignants sur ces actions et stratégies sont présentées.



***Mots clés :*** recherche « formative »; auto-détermination; éducation physique et santé; filles.

## Introduction

Children and youth between the ages of 5 and 16 will spend approximately 43% of their waking hours in school (Higgins, 2001). Since all Canadian youth spend a large proportion of their time in school, the school domain could play an important role in promoting daily healthy behaviours including mindfulness, proper nutrition, and physical activity. Physical and health education (PHE), in particular, offers an avenue for learning healthy behaviours and participating in physical activity. PHE is one of the few disciplines responsible for promoting lifetime physical activity and health for all youth at school. Specifically, in British Columbia (BC), PHE "focuses on well-being — the connections between physical, intellectual, mental, and social health" and directly addresses not only physical activity, but also physical literacy, healthy and active living, social and community health, and mental well-being (British Columbia Ministry of Education, 2016).

It has been suggested, however, that PHE is not meeting the fundamental goal of promoting health and physical activity for all young people (McNamee & Timken, 2017). It is true that students' physical activity and health behaviours are complex and multifaceted, and PHE alone cannot ensure young people meet national physical activity recommendations; however, some in the field believe PHE could be doing more to promote lifelong physical activity and health. One critique is that PHE is too reliant on one category of physical activity, competitive team sports (Fairclough & Stratton, 2005; Trost, 2006), rather than lifetime physical activities. Fairclough et al. (2002) suggested that PHE within "schools place a significant emphasis on team games, often at the expense of lifetime activities" (p. 69). Trost (2006) stated that PHE has enormous potential to promote physical activity and to prepare young people for a lifetime of physical activity and health engagement; however, programs have not "delivered the goods" when it comes to promoting lifelong physical activity.

Low motivation to participate in traditional or team sports, apathy toward competitive environments, and a low rate of transfer of skills to lifetime activities and wellness can be barriers for students' pursuit of lifelong physical activity and health (Nguyen, 2015). For many young people, their engagement with physical activity outside of school and in the community is antithetical to the physical activity experiences provided to them through their formal PHE curriculum (Macdonald, 2003). Students have criticized PHE for being disconnected from their lifestyle contexts and for lacking relevance and meaning (Enright & O'Sullivan, 2010; Gibbons & Humbert, 2008).

Lifetime activities are defined as those activities that people continue to participate in throughout life because they can be done individually or with others, require little organization, and minimal equipment (Fairclough et al., 2002). Many of these activities occur outdoors and in nature: walking, running, hiking, swimming etc. To try to remedy the lack of relevance and meaning of activities mentioned, it appears relevant to investigate whether alternative teaching practices, such as nature-based physical activity (NBPA) in PHE could provide solutions to enhance children and youth's physical activity and health behaviours as well as provide the link between physical activity *within* PHE and lifetime physical activity *beyond* PHE. NBPA refers to physical activities that are done in natural areas, require little specialized equipment, deemphasize competition, focus on a connection to nature, can be participated in by the majority of youth, are cost-efficient and can be implemented by teachers on a regular basis (Gruno & Gibbons, 2023, 2020, 2021). Recent literature strongly supports students' interaction with nature, outlining several benefits

ranging from increased physical activity and cardiorespiratory fitness (Gray et al., 2015) to prosocial behaviours (Bølling et al., 2019), life satisfaction, mindfulness (Mutz & Muller, 2016) and mental wellbeing (Tillmann et al., 2018).

**Formative Research Process**

Due to the importance of promoting lifetime physical activities in nature within PHE, we were interested in ways to help teachers add new NBPA strategies to their repertoire. To do this, we used formative research with members of a schools-university partnership. Formative research involves gathering data, either qualitative, quantitative, or both, useful for the development and implementation of innovations. We borrow Century and Cassata's (2016) definition of innovations: "as programs, interventions, technologies, processes, approaches, methods, strategies, or policies that involve a change (e.g., in behavior or practice) for the individuals (end users) enacting them" (p. 170).

One of the major characteristics of formative research is appropriateness – aiming to make the final innovations both culturally and geographically appropriate (Gittelsohn et al., 2006). Although there is ample evidence that school-based innovations can be effective (e.g. Naylor et al., 2015; Owen et al., 2017), there is a lack of literature in outlining how schools-university partnerships can assist in implementing innovations like NBPA in schools.

A schools-university partnership is a collaboration between a group of teachers from a number of schools and a university research team which can lead to professional development, the creation of practice-based research and knowledge (Baumfield & Butterworth, 2007; McLaughlin & Black-Hawkins, 2004) and positive change in school PHE (McCaughtry et al., 2012). Some basic conditions have been established in the literature as key to developing a successful partnership, such as identifying mutual benefits, common interests, collaborative action and reciprocity (McLaughlin & Black-Hawkins, 2004). Thus, our schools-university partnership project involved two phases of formative research activities conducted with the members of the partnership to determine and implement the best approaches to NBPA innovations in a variety of school contexts. These approaches to NBPA were oriented by the notion of relatedness.

The design of this project is grounded in the self-determination theory of motivation (Deci & Ryan, 1985; Ryan & Deci, 2000, 2020). Self-determination theory assumes people are inherently prone toward psychological growth and integration, and thus toward learning, mastery and connection with others. However, these proactive human tendencies are not seen as automatic, they require supportive conditions to be robust (Ryan & Deci, 2020). Hence, motivation to engage in a particular behaviour, such as meaningful engagement in PHE or lifetime physical activity, is influenced by an individual's need for autonomy, competence, and relatedness, and thereby impacted by the support for these three basic psychological needs within the environment (Ryan et al., 2019). In this project, relatedness refers to the perception of belonging and feeling connected both to classmates and to educators. Relatedness was selected for the focus of this research because there is persuasive evidence that relatedness is a key ingredient in PHE motivation (Cox et al., 2009; Standage et al., 2005). Students' social recognition and status goals have also been found to predict extra-curricular physical activity participation (Wallhead et al., 2013). Additionally, Mann et al. (2021) report that learning in nature has been proven to foster

communication, reasoning, and interactional abilities, while also enhancing 21st century skills such as resilience, collaboration, conflict resolution, and self-regulation.

Formative research provides a platform to understand the needs, interests and attributes of schools prior to innovation design and implementation. This is particularly important in multi-centered projects where variability is likely to exist within and between schools (Young et al., 2006). Gittelsohn et al. (2006) identified a key gap in the formative research literature, the fact that "the process of using formative research findings to inform subsequent [innovations]" (p. 27) is rarely described. Although formative research is often conducted prior to implementation of an innovation, the description of the process of formative research is not frequently published separately from the results of the innovation (Gittelsohn et al., 2006). This paper helps to fill that gap by thoroughly outlining the second phase of a formative research process. Collecting multiple phases of formative research data is useful in large multi-school innovations (Moe et al., 2006) like those we are proposing through the schools-university partnership.

In previous research conducted by the authors, teachers involved in the on-going schools-university partnership brainstormed and implemented actions with their PHE classes which were associated with autonomy, competence, and relatedness. The focus was on increasing girls' motivation in PHE as there is a wealth of research that shows the disengagement of female-identifying students in PHE (e.g., Enright & O'Sullivan, 2010, 2012; Garrett, 2004; Oliver & Hamzeh, 2010). The teacher partners and the researchers also decided to focus on relatedness because when compared to the concepts of autonomy and competence, there has been far less research emphasis on the factors most likely to help students feel socially related during their PHE classes. Therefore, the focus of the partnership was narrowed to relatedness as the teachers identified that relatedness-supportive strategies are especially important for students in PHE, particularly for girls, and this was supported by research (Eime et al., 2013; Pfaeffli & Gibbons, 2010; Sammet, 2010; Shen et al., 2012). The teachers then added specific strategies associated with relatedness and documented the use of said relatedness strategies in their PHE classes (Gibbons, 2014). Using formative research, the researchers then identified the "least used relatedness strategies" (service-learning strategies and use of technology) and invited the teachers to design innovations that focused on one of these strategies to implement in their schools. The teachers shared these projects with one another, and two were disseminated to a larger audience through publications (Gruno, Gibbons, & Baker, 2018; Gruno, Gibbons, Condie, et al., 2018) . This paper continues this line of inquiry by focusing specifically on the use of NBPA to foster relatedness in PHE for female students.

Co-production is a means of involving the target audience in both the design and implementation stages of an innovation, and it has shown a greater degree of innovation engagement (Greenhalgh et al., 2016) due to being contextually appropriate. Co-production is aligned with an actor-oriented analysis of curriculum implementation as it relies on the teacher's, or insider's, point of view (Penuel et al., 2014). Wight and colleagues (2015) emphasize the value of co-production in maximizing the likelihood of innovation effectiveness by improving innovation fit with considerations for the target audience, in this case teachers, perceived needs and acceptability, practicality, and implementation and uptake. Such an orientation focuses on teachers' formulations of goals, their decisions about what to implement or adapt and the reasons they give for implementing innovations the way that they do (Penuel et al., 2014). This orientation

provides specific insights that offer clues as to how activities and associated professional development activities need to be modified to support teacher learning. By adopting this actor-oriented, co-production approach in our project, the design of the future NBPA innovations incorporated study data from both phases of this formative process alongside teacher practice-expertise and knowledge to increase the likelihood that the new NBPA innovations would be embraced by the teachers and become a permanent part of their practice. As part of the formative process, the teachers were able to work out the "real world" issues of context and barriers to implementation. It is during this implementation of NBPA innovations that the research data were collected.

## Methodology

This section presents the methodology used in the formative research process, including a description of the overall research project, the participants, and the activities involved in the first and second phases of the process.

### Overall Research Project

The formative research second phase described in this paper is part of a larger project designed to enhance the relatedness support of girls in PHE through NBPA during middle school (grades 6-8), and high school (grades 9-12). The goal of this project, at the end of the formative research process, is to implement several NBPA innovations that are informed by the research process, with PHE teachers and students across a variety of school contexts. The hope being that NBPA will become a permanent part of their teaching and learning practice. This project involved a schools-university partnership with a large university in BC, Canada. The partnership draws participating teachers from a variety of school districts in BC including wide geographical areas and diverse populations.

### Participants within the Schools-University Partnership

The 20-30 teachers currently involved in the partnership represent a range of teaching conditions in a variety of school districts throughout BC. The first phase of this research included 20 teachers (18 women, two men) from 13 different schools. In this second phase, eighteen teachers within the partnership helped to refine the action checklist for use in their PHE classes, and nine teachers used and completed the checklist with their PHE classes. See Table 1 for a summary of school details for the nine participants.

### First Phase: Designing the Action Checklist

As described in Gruno and Gibbons (2021), the first phase of this formative research utilized Wight et al.'s (2015) first four steps: with the teachers we (a) defined the problem – girls' lack of motivation in PHE and its causes (one problem being the types of activities typically offered in PHE); (b) identified which causal or contextual factors are modifiable – the types of activities, namely lifetime NBPA; (c) decided on the mechanisms of change – incorporating further NBPA in PHE programs; and (d) clarified how these will be delivered – through the development and usage of a NBPA action checklist.

**Table 1**
*Participants' School Details*

| School detail | Number of participants |
|---|---|
| Grade levels | |
| 6-8 | 1 |
| 8-12 | 3 |
| 9-12 | 5 |
| Type of school | |
| Public | 7 |
| Independent | 2 |
| Student population | |
| >500 | 3 |
| 500–1000 | 1 |
| >1000 | 5 |
| Location of school | |
| Rural | 2 |
| Suburban | 4 |
| Urban | 3 |
| Percentage of persons in low income in school catchment | |
| <10%* | 2 |
| 10–20%* | 6 |
| >20%* | 1 |

*Data taken from the 2016 Census (Statistics Canada, 2016).

**Second Phase: Using the Action Checklist**

The current paper outlines phase two of the formative research process and focuses on Wight et al.'s (2015) fifth step, test and refine on a small scale - namely refining the action checklist, and sixth step, collect sufficient evidence of effectiveness to proceed to implementation – the use and results of the NBPA checklists. To begin the second phase, we first met with the nine teachers for a full day session and presented each of the teacher participants with a draft action checklist that was developed as a result of phase one. They were then asked to edit the checklist to ensure that it was user-friendly and focused on the partnership's goals. The teachers were arranged in groups of 4-5, each with a trained facilitator, and the facilitators led the groups through a series of questions (see Annex 1) designed to refine the checklist. The facilitators then recorded all of the participants' feedback on the changes and usability of the checklist.

We then asked the participants to look over the checklist a final time and provided them with some brainstorming time in which we asked them: *What are some specific nature-based physical activities or actions you plan to implement in your PHE course(s) next semester? Discuss as a group, share ideas and resources.* After the meeting, the lead

author applied all of the feedback on the draft in order to update the action checklist. The final version involved further examples in the action suggestions and multiple options for teacher responses in the checklists, both elements are described in further detail below. We then invited the nine participants to use the updated checklist to document the implementation of 'NBPA to support relatedness for girls in PHE actions' in one or more of their PHE courses the following term.

### *Action Suggestions*

For each of the three topics (NBPAs to incorporate in PHE; Connecting with place actions; Relatedness supportive actions), we created categories and provided as many specific example activities and actions as possible to further elaborate each category. For example, within the topic "NBPAs to incorporate in PHE," under the category of "Survival Skills," we placed "E.g., building shelters, lighting fires, herbalist/edible plants, community campground, Indigenous knowledge, safety/preparedness, food preparation for trips." The actions were designed for teachers to visit and revisit as required, as it was considered likely that teachers would implement some of the actions in different ways throughout the term.

### *Action Checklists*

The purpose of the action checklists was to provide comprehensive documentation of the NBPA activities and actions teachers implemented in their PHE courses that coincided with the three topics. The actions in each topic were consolidated into several major categories accompanied by four check boxes, and a space to explain the action. See Figure 1 for the first page of the action checklists, including the completion instructions for participants.

**Figure 1**

*NBPAs to Incorporate in PHE Action Checklist*

**Keep the definitions of "relatedness," "relatedness supportive,"** and **"nature-based physical activity"** in mind throughout the checklist.

**Relatedness** is the feeling of being connected to others in a social context. In turn, **relatedness-support** refers to the social environments in which individuals have the opportunity to develop healthy relationships with others.

**Nature-based physical activity:** physical activities that are done in natural areas, require little specialized equipment, can be done by the majority of youth, are cost-efficient and can be implemented by teachers on a regular basis.

**Instructions for completion of checklist:**

- Read through the left column and identify actions you already use in PHE or would like to use in PHE.
- Throughout your PHE courses take note of these actions and check one of four boxes for each action you perform in your classes:
  - *Yes/old:* Check this box if you were already doing this action and are simply continuing existing practice.
  - *Yes/new:* Check this box if this is a new action that has been added.
  - *How often:* If you checked "yes/old" or "yes/new" then place how often you incorporate the action or activity – e.g. once a week, once a month, once per course etc.
  - *No:* Check this box if you do not have this action in your program (although it is possible).
  - *N/A:* Check this box if the action is Not Applicable to your course/program.
- Beside the action box you will check, please provide some specific details such that another teacher can use your ideas and actions.
- Please see the example.

| 1. NBPAs to incorporate in PHE: | Yes old | Yes new | How often | No | N/A | Comments: |
|---|---|---|---|---|---|---|
| **Kayaking/Canoeing/Paddle boarding/ Dragon boating/Sailing**<br>• *Please note, the above activities do not fit the definition of NBPA (i.e. they cost money, are more challenging to organize etc.), they are simply here to illustrate how to fill out the checklist | X | | ONCE A COURSE | | | **SAMPLE ENTRY**<br>This takes the form of a one-time field trip with Women's Active Living. We rent the boats through Rush Adventures in Sooke and have to apply for funding through PAC. I find the girls really appreciate the chance to be on the water with their friends. |
| **Hiking/Nature Walks**<br>• E.g. Mt. Finlayson, Mt. Tolmie, Mt. Doug, Swan Lake, Mt. Wells, Bear Hill, Centennial Park, The Great Trail resource | | | | | | |

In order to document the NBPA actions implemented in their PHE courses, the participants were asked to check one of four boxes for each action listed:

- *Yes/old:* Check this box if you were already doing this action and are simply continuing existing practice.
- *Yes/new:* Check this box if this is a new action that has been added.
- *No:* Check this box if you do not have this action in your program (although it is possible).
- *N/A:* Check this box if the action is Not Applicable to your course/program.

If participants checked "yes/old" or "yes/new" they were also asked to fill in the "How often" column – "e.g., once a week, once a month, once per course etc." Beside the action boxes teachers checked, in the far-right hand column, they were asked to provide as much specific detail such that another teacher could use their ideas. For example, if they taught a particular forest game to their students, they were asked to describe the context and rules for the game. It was anticipated that for many of the actions it was likely that teachers would be documenting actions that they were already using. For example, a teacher may have already been hiking weekly with her or his students – in such case the teacher was asked to simply check the "yes/old" box and describe the locations and nature of these hikes.

## Discussion

As this paper focuses on formative research, it is important to note that this research is an ongoing process. The co-production involved back and forth interactions with participants, allowing the actions on the checklist to continue to progress. The refining of the action checklists inspired specific examples to be generated which prompted the participants to provide specific details on the NBPAs they implemented with their PHE classes. We have included the results of the action checklists in the next section.

### Results of the Action Checklists

For those NBPAs listed in the action suggestions that were new to the teacher's PHE program, they were asked to incorporate as many as possible (keeping in mind feasibility and sustainability). In other words, the goal was to add actions the teacher considered to be sustainable and not overwhelming. This was of course the plan, and then the global pandemic, COVID-19, hit and we had to come up with an alternative plan. At the time of lockdown, the teachers had only taught approximately six weeks in-person when the pandemic closed schools and turned instruction to virtual means. As a partnership, we decided to proceed with the teachers completing the checklists. We instructed the teachers to use the code, "C19," in the action checklist description column for activities that they asked their students to complete when learning from home. Each of the nine participants received an electronic copy of the checklist and completed it either through a word processing software or recorded their actions by hand, scanned the document, and emailed it to the lead author.

Overall, teachers checked "yes" and either "old" or "new" for the majority of the actions across the three topics. These results provide promising support to the utility and practicality of NBPA innovations across the diverse school contexts represented in the

schools-university partnership. The results also showed interesting insight into actions that teachers identified as already part of their practice ("old"), and actions they chose to add ("new"). See Figure 2 for an example completed action checklist by one of the participants.

**Figure 2**

*Sample Participant Completed Action Checklist for "Connecting with Place Actions" Topic*

| 2. Connecting with place actions: | Yes old | Yes new | How often | No | N/A | Comments: |
|---|---|---|---|---|---|---|
| **Emphasize nature as the focus**<br>• E.g., utilize natural materials in the activity, focus on using senses when in nature, respect what is alive, nature art (mandalas, sculptures) | | X | Once a month | | | **PHE 11/12:** We had the students build rock cairns, create maps out of sticks, rocks, dirt, and leaves. |
| **Focus on developing comfort in the natural world**<br>• E.g., make sure students are prepared ("there's no such thing as bad weather, only bad clothing"), First Peoples Principles of Learning | | X | Once a week | | | **PHE 11/12:** After introducing different types of clothing, we took students on multiple hikes in the rain and different elements. |
| **Emphasize lifetime physical activity (options beyond PHE)**<br>• E.g., Ask students to try an activity in nature within their community and report back, passport to PHE, peer teaching opportunities | | X | Once a course | | | **PHE 8:** I had grade 12 students lined up to teach different games to my grade 8's. For example: cricket, rowing, Irish football |
| **Provide a break from technology**<br>• E.g., require phones are away on a nature walk, effective use of tech | X | | Once a week | | | **PHE 10 & PHE 11/12:** Students were not allowed to have their phones out during walks around [local lakes and mountains]. |
| **Emphasize place-based education**<br>• E.g., Discuss how lucky we are to live in this area, mention local parks or trails students could utilize on their own time, get students involved, connect to land and local Indigenous history | X | | Once a week | | | **PHE 10 & PHE 11/12:** We talk about the accessibility of local parks/beaches/hikes in our community.<br><br>**C19:** Students documented their favourite local beach/trail/hike etc. |
| **Emphasize respect for our environment**<br>• E.g., include 'teachable moments' on picking up garbage, engage in conservation activities (beach clean-ups), trail building, leave no trace principle | | X | Once a course | | | **PHE 11/12** Taught the 'Leave No Trace' concept. |
| **Other:** (actions that fit in category but not listed) | | | | | | |

It is important to note that many of the teacher responses were "Yes, Old". Several members of the partnership have been involved for years, and the partnership has been dedicated to facilitating actions associated with self-determination theory in PHE for some time. Therefore, it is possible that the teachers had already made these kinds of actions common practice in their teaching of PHE.

We read over all the teachers' entries in their checklists to identify new actions (labelled as "Yes/New"). Given that the intent was both to have teachers document their practice with the checklists as well as provide them with ideas via the suggested actions, it was important to identify new actions that teachers successfully implemented. As part of this process, over 38 new action suggestions were identified which provides promising information for future NBPA innovations. For example, under "NBPAs to incorporate in PHE" Kayla adapted to virtual teaching and asked her students, under the category of "Backyard Games", to "create an outdoor obstacle course that incorporates skills and components of fitness. Describe it to [her] or send [her] a video." While under the "Mindfulness Activities" category, Jaime, as part of her students' at-home learning, asked

them "to complete a meditation (which [she] provided) and encouraged them to do it outside." Desiree, on the other hand, was able to implement a new mindfulness activity prior to lock-down:

> For the first time we tried a mindfulness activity for a mental health focused day. We had a nature hike, some stretching, and then followed a meditation app (*Headspace*) for 5 minutes. It was with my senior class (mostly girls) and they seemed to really enjoy it. We did this at a particularly stressful time for them academically.

Within the "Connecting with place actions" topic, under the "Emphasize nature as the focus" category, Kayla encouraged her students, when learning at home, to utilize their senses while in nature: "C19: Nature bathing – Go for a walk or choose a place to be still in nature. What 5 things do you see? 4 hear? 3 feel? 2 smell? 1 taste?" Under the "Emphasize respect for our environment" category, prior to the lock down, Eliza taught the "No Trace" concept in-person with her senior PHE class. Additionally, Maria directed "Focus on developing comfort in the natural world" category by asking her students "to reflect and share with the class on how weather affects their decisions or motivation to be physical active." Finally, under the "Relatedness supportive actions" topic Jaime aimed to "Facilitate time for students to interact" (category):

> If we run up to [the local park] to do a workout or a game, I make sure we end the activity early enough that we can walk back and students have the time to interact (without their phones distracting them) and have some real conversations.

The teachers were able to describe these new NBPA actions in enough detail that other members of the schools-university partnership would be able to replicate them. Our next step in the formative research process will be to gather the teachers together for a debriefing session. The debriefing task will focus on asking teachers to identify up to three "high impact actions" for each of the three topics. High impact actions will be defined as those NBPA actions each teacher considered to make the most impact with students. The purpose of this task will be to get an indication of the actions teachers think make the most difference. In doing so, this will provide insight and focus for the future NBPA innovations in schools.

**Implications and the Next Phase**

The purpose of this paper was to describe the second phase in a formative research process used to develop an action checklist to help teachers make PHE more meaningful for their female students by increasing NBPA actions that support relatedness. The process emphasizes the valuable contribution formative research can make to the overall context-appropriateness, integrity and fidelity of a school-based innovation. Contexts can affect innovation enactment in legitimate ways; exact replication is not always possible or even desirable; and improving education requires processes for changing individuals, schools, organizations, and systems (Century & Cassata, 2016). The teachers in this study showed that they enacted activities in PHE in different ways while still retaining the purpose of fostering relatedness for their students and helping them engage in lifetime NBPA. Their responses helped us answer *what* they actually enacted, *how* they enacted the NBPA innovation, and *why* their contexts, conditions, characteristics, and other influences shaped innovation enactment as they did (Century & Cassata, 2016).

The structure and content of the action checklist, the output of the co-production, provided a dependable guide for participating teachers in the implementation of NBPA actions consistent with relatedness. It helped teachers integrate new actions within their individual PHE contexts, allowing for adaptation across different circumstances while maintaining integrity of the theoretical framework. In particular, having teachers work with the checklist in the second phase was critical to strengthening the theory-to-practice connection. The process of having teachers provide details of their implemented NBPA actions generated many ideas for the action suggestion categories. This result supports the contention by Moe et al. (2006) and Young et al. (2006) that this type of formative process is necessary in order to build consistency across different school contexts, which is an unavoidable circumstance in larger school-based innovations. Overall, we believe that this type of formative research process can contribute to quality practice in the implementation of theory-based innovations in schools and the overall shared goal of "making (physical and health) education better" (Century & Cassata, 2016, p. 169).

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## Annex 1

*Questions Asked in Focus Groups*

1. Read through the left-hand column in **section #1 (NBPAs to incorporate in PHE)**. Go through each bolded activity category, are there any further examples (bullet points) to add to further clarify the types of nature-based activities we already (or could) do in PHE?
2. Read through the left-hand column **in section #1 (NBPAs to incorporate in PHE)** again. Are there any activity categories (rows) that we should add, take away, or change? Keep the definition of **nature-based physical activity** in mind: ***physical activities that are done in natural areas, require little specialized equipment, deemphasize competition, can be done by the majority of youth, are cost-efficient and can be implemented by teachers on a regular basis***.
3. Read through the left-hand column in **section #2 (Connecting with place actions)**. Go through each bolded action category, are there any further examples (bullet points) to add to further clarify these actions?
4. Read through the left-hand column in **section #2 (Connecting with place actions)** again. Are there any connecting to place actions (rows) that we should add, take away, or change?
5. Read through the left-hand column in **section #3 (Relatedness supportive actions)**. Go through each bolded action category, are there any further examples (bullet points) to add to further clarify these actions?
6. Read through the left-hand column in **section #3 (Relatedness supportive actions)** again. Are there any relatedness supportive actions (rows) that we should add, take away, or change? Keep the definition of **relatedness-support** in mind: ***refers to the social environments in which individuals have the opportunity to develop healthy relationships with others.***

*Note.* For a visual reference of the result of these focus group questions, see the sample left-hand column of the revised checklist in Figure 2.