Author’s response to reviews

Title: The feasibility and impact of embedding pedagogical strategies targeting physical activity within undergraduate teacher education: Transform-Ed!

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Author’s response to reviews:

Pilot and Feasibility Studies
PAFS-D-19-00059
The feasibility and impact of embedding pedagogical strategies targeting physical activity within undergraduate teacher education: Transform-Ed!
Natalie Lander, Harriet Koorts, Emiliano Mazzoli, Kate Moncrieff, Jo Salmon

Reviewer #1:

Reviewer # 1 Comment 1: Background section: The authors provided sufficient evidence to support the need for children to be more physically active throughout the school day.

Author response 1: Thank you for your support of the rationale we provided for children to be more physically active throughout the school day.

Reviewer # 1 Comment 2: Much more information/rationale/evidence is necessary to support the situation of the "evidence-based active pedagogy" within the pre-service teacher education program -- the authors mention much of the actual rationale in their discussion (e.g. references 37, 38, 40 to name a few), which, should have been introduced in the "background and/or literature review" leading up to the purpose of the study (e.g. mention other promising practices in introduction, don't wait until discussion.

Author response 2: Thank you for this recommendation. Additional information, rationale and evidence to support the situation of the "evidence-based active pedagogy" within the pre-service teacher
Although Transform-Us! was highly successful, it may not be possible to continue delivering face-to-face professional development to in-service teachers, as it is time, resource and cost intensive, and thus, perhaps not sustainable. Integrating active teaching pedagogy into initial or pre-service teacher education may provide a more effective and potentially more sustainable approach.

Pre-service teacher education programmes aim to prepare graduates to become quality teachers equipped with pedagogical practices that will serve to meet the increasing demands associated with the teaching profession (21). Indeed, pre-service teacher education provides an integral platform for scaffolding critical pedagogical skills, strategies, knowledge and capabilities (22), and as such is viewed as a crucial link in producing quality teachers and more positive student outcomes (21). The impact of pre-service teacher education on teachers’ effectiveness and students’ outcomes is internationally recognised as pivotal (22), yet it is an under-studied and perhaps under-utilised setting for physical activity and sedentary behaviour intervention research.

Reviewer # 1 Comment 3: It appears that the concept of "transformative education" is important --- I suggest the authors provide more information on how this actually shows up in the design and delivery of the intervention -- in more detail.

Author response 3: Thank you for the suggestion to include more information around transformative pedagogy in the design and delivery of Transform-Ed! This has been expanded on and is presented in lines 223-236 of the manuscript, as shown below:

Transformative education suggests that learning is understood as a process of using a prior interpretation to construe a new or revised interpretation of the meaning of one’s experience to guide future action (28). Specifically, transformative education is teaching and learning that effects a change in perspective (29), which might be an especially relevant approach in relation to initial teacher education around increasing physical activity and decreasing sedentary behavior across the school day. The baseline survey (as explained below in procedures) collected data on the pre-service teachers’ own experiences and observations of active teaching/learning when they were students. In line with the transformative values of reframing education (29), this data was used not only as baseline data by the researcher, but also as diagnostic assessment by the academic educators, to identify the explicit learning experiences and capability deprivations of the pre-service teachers. Specifically, the pre-service teachers who had recorded the most negative active learning experiences as a student, were provided with the most comprehensive education, opportunity and experience around active teaching (29).

Reviewer # 1 Comment 4: A frustrating part throughout the manuscript was reference to "additional files." These files were more than "supplementary." In my opinion, they were necessary to understand and interpret parts of the manuscript. The reader should not have to go to these files to understand the manuscript.

Author response 4: Thank you for your recommendation to include the supplementary information within the manuscript. The supplementary table has now been included within the manuscript and appears as Table 1, seen at line 219.

In addition, the table has been expanded considerably to more clearly present how Transform-Ed! key
messages and strategies were embedded across the ‘Introduction to Curriculum and Pedagogy’ Unit of the Bachelor of Education (Primary) Degree. This additional information is highlighted in yellow in the table.

Furthermore, additional information is now presented in the manuscript around the intervention content, concepts and delivery, as seen in lines 205-218 and below:

…the Transform-Ed! intervention content included learnings around three key areas, namely: (i) classroom-based physical activity/active teaching (e.g., physically active academic lessons, active breaks, health-based curriculum content); (ii) active environments (e.g., encouraging activity at recess and lunchtime); and (iii) active families (e.g., engaging families via active homework). The key messages were disseminated to pre-service teachers, by the academic educators, in the following ways: modelling active teaching and active breaks throughout lecture and seminars; providing the theoretical underpinnings of the importance of physical activity in lectures; delivering education around pedagogies that are designed to promote activity; facilitating peer micro teaching opportunities, whereby the pre-service teachers practice active teaching strategies and receive peer and lecturer feedback in seminar sessions, and; the provision of comprehensive resources on active teaching, active breaks and active homework examples. Examples of the Transform-Ed! content and how this was embedded by academic educators is provided below in Table 1.

Reviewer # 1 Comment 5: Design: 1: This is somewhat confusing. I suggest using only the affirmative numbers at all stages (aka the numbers of participants that consented and participated).

Author response 5: The figure has been amended as per your recommendation. Only numbers of consenting participants now appear in Figure 1 at lines 170-184 of the manuscript.

Reviewer # 1 Comment 6: Please provide more rationale for the inclusion of the "senior academics" -- what was the purpose of including their input? It is clear as to why you would want information from the students, academic teachers of the course, and primary principals -- however, the "senior academics" is less clear and give the amount of focus in the results from this group --more rationale would be helpful.

Author response 6: Thank you for your suggestion for more information regarding the involvement of the senior academics in the study. The senior academics are important stakeholders, they hold positions of responsibility and subsequently are responsible for key decisions across the School of Education, pre-service teacher education and the university more broadly. They are highly influential stakeholders, thus their perceptions around program feasibility as well as their views around the potential for continued implementation of Transform-Ed! are integral. Please find below a justification for their involvement. The manuscript has now been amended to reflect this in lines 148-158.

The senior academics are crucial decision makers and gatekeepers regarding course and unit design, structure, curriculum, modes of delivery, assessment and policy. As such, an understanding of the views of these key stakeholders not only helps to inform the feasibility of the intervention but is also integral to the development of a future definitive trial. The senior academics invited into the study included, Head of School (School of Education), Associate Head of School (School of Education), Director of Research (School of Education), Head of Teaching and Learning (School of Education), Course Director (Bachelor of Education: Primary), Unit Chair (Curriculum and Pedagogy), Course Direction (Health and Physical Education), Unit Chair (Mathematics and Children), and Unit Chair (Literacy Teacher Learner).
Reviewer # 1 Comment 7: Intervention: Provide more information on the course in which the "evidence-based active pedagogy" was included --- what was the content and structure of this course? Where were the students in their program? More information on content and structure of lectures and practical sessions is necessary to understand the actual intervention.

Author response 7: More information about the course in which the “evidenced-based active pedagogy” was incorporated has now been included as recommended, please see below and lines 186-191 of the manuscript.

Transform-Ed! was embedded into one core curriculum and pedagogy unit of the Bachelor of Education (Primary) degree. The targeted unit is the first curriculum and pedagogy unit in a series of eight scaffolded units across the four-year degree. It introduces core elements of the primary (elementary) curriculum and relevant pedagogies, drawing on examples from health and physical education, literacy and mathematics. It is a 12-week unit, including 12 one-hour lectures and 12 two-hour seminars.

In addition, more information about how the intervention content was embedded across this unit is included in the manuscript, as presented above in the authors’ response to Reviewer # 1 Comment 4, and seen in lines 205-218 on the manuscript.

Reviewer # 1 Comment 8: Lines 163 - 172 - more information is needed to better understand the content of and how the strategies were implemented (e.g. did students actually practice with primary students?) and how they translated from pre-service into a primary classroom (e.g. were the practical sessions in primary schools?). I found myself going to the "additional files" to find out much of this information --- it was frustrating to have to go to the additional files to get information to explain. I would like to see more of the information from additional files in the body of the manuscript. In my opinion, the reader shouldn't have to keep going to the additional files to understand the intervention.

Author response 8: The supplementary/additional files table has now been included within the manuscript and appears as Table 1, seen at line 219. In addition, the table has been expanded considerably to more clearly present how Transform-Ed! key messages and strategies were embedded across the ‘Introduction to Curriculum and Pedagogy’ Unit of the Bachelor of Education (Primary) Degree, and how the pre-service teachers practiced these strategies in seminar sessions. The additions have been highlighted in yellow in the table.

Furthermore, additional information around how the key messages were disseminated to pre-service teachers has been added to the manuscript text as shown in lines 205-218. Please see response to Reviewer # 1 Comment 4 above.

Reviewer # 1 Comment 9: Measures/data collection. As mentioned earlier -- please provide more information on purpose of focus groups with "senior academics" ---and sample focus group questions -- within the text. The senior academics were not actively involved in any part of the intervention, yet their input comprised much of the results section.

Author response 9: Thank you for your point around the involvement of the senior academics. This has been addressed in detail in the Author Response to Reviewer # 1 Comment 6 presented above, and presented in lines 148-158 of the manuscript.
Reviewer # 1 Comment 10: Results: Table 1: I am unsure as to the purpose of the information in this Table. The personal experience of the students was not mentioned in the design and I'm not sure how it fits in the overall study -- it seems to appear in the results without any lead up? I suggest that it be removed.

Author response 10: Thank you for your recommendation around removing the table presenting the personal experience of the pre-service teachers as students. Table 1 has now been omitted from the manuscript and is now included only in the additional files (additional file 3).

In addition, we have now removed reporting of the personal past experiences of the students from the study aims (lines 116-121).

However, the pre-service teachers’ prevailing negative experiences of physical activity and physical education are of particular concern given that the personal school experiences of classroom teachers are significant predictors of their confidence to teach activity-based curricular and physical education, and significantly influence the quality of their teaching in these areas. Therefore, it was necessary to ascertain what (negative) experiences the pre-service teachers were bringing with them in order to disrupt pre-conceived (negative) notions of school-based physical activity. As mentioned in the manuscript (lines 228 - 236), the baseline survey collected data on the pre-service teachers own experiences and observations of active teaching/learning when they were students. In line with the transformative values of reframing education, this data was used not only as baseline data by the researcher, but also as diagnostic assessment by the academic educators, to identify the specific learning experiences and capability deprivations of the pre-service teachers. Specifically, the students who had recorded the most negative experiences as a student were provided the most comprehensive education, opportunity and experience around active teaching to provide knowledge as a way to achieve educational reform. Therefore, the authors see the pre-service teachers own experiences of active teaching as an important aspect of the study, and thus remains worthy of discussion.

Reviewer # 1 Comment 11: Given that this was examining feasibility of Transform Ed -- it was troubling that the two groups who were the most actively involved (students and academic instructors of the course) received the least amount of attention in the results -- both these groups experienced first-hand how the intervention "worked or didn't work," and I would think the information from them would be front and centre. The bulk of the results focused on the "focus group discussion" of senior academics and principals --- yet neither of these groups had any first hand involvement in the actual pilot of the intervention. All their discussion was hypothetical, which, in such a pilot I think is much less important and provides little actual guidance to actual feasibility --- they weren't involved in the planning/delivery etc., such that their comments about "yes, it is feasible" hold minimal weight (in my opinion). Given this described as a pilot of Transform ED --- the information from those directly involved in the implementation should used. I would expect to see more information from the "deliverers" and "receivers" of the intervention and less from the senior academics (having no actual involvement in the pilot).

Author response 11: Thank you for your comments around the emphasis of the results section. Amendments and justifications around the results are provided below:

In addition to the pre/post survey results of pre-service teachers, the results section now features the pre/post survey responses of the intervention deliverers (academic educators) in Table 3, lines 352, as recommended, to further emphasise the importance of these participants in relation to intervention feasibility.
However, as this study was a pilot feasibility study, the perceptions of key decision makers (senior academics) and stakeholders (principals) form an integral component of the design and thus the findings, in order to ascertain the potential for the pilot study to be considered for the progression from pilot to a definitive trial. Therefore, engagement with these key stakeholders in the early stages of research (e.g., pilot or feasibility research) is not only encouraged, but integral. Their engagement and perception are part of forms an iterative research process of the research whereby the researcher is actively ascertaining the knowledge, experience and perceptions of the individuals selected to represent a broad range of direct interest groups (i.e. decision makers and stakeholders) in a particular issue. These aspects are crucial, for the dual purposes of: creating a shared understanding, and; making relevant, transparent and effective decisions around the progression and future development of the research. As previously noted in response to Reviewer #1 Comment 6, results from the focus groups and interviews are important for informing the progression of this research from pilot to trial in terms of feasibility from an organisational perspective.

Reviewer #1 Comment 12: Discussion: As mentioned in my comments about the "background/introduction/lit review," I think much of what you mention in your discussion, should have been introduced at the beginning of the manuscript to "set up" the rationale for "why evidence-based active pedagogy" is a good fit in pre-service teacher education. For example, all information on teacher identity (e.g. 37, 38, 40) should have been introduced to the reader earlier. The "practice" of not introducing "new" literature in the discussion (that hasn't been mentioned in the intro/lit review is relevant here. As transformative education was a major concept -- please strengthen the definition and how it plays out more clearly in content and structure of the pilot.

Author response 12: Thank you for your suggested restructuring of the introduction and procedures to better include rationale for "why evidence-based active pedagogy" is important in pre-service teacher education, as well as expanding on transformative education. Amendments have now been made to the manuscript to include recommended information. Please see authors’ response to Reviewer #1 Comment 2, as seen in lines 98-111 of the manuscript.

In addition, the authors have now included more detail around transformative education to more clearly explain how this pedagogy was included in the structure and content of the pilot. Please see the author’s response to Reviewer #1 Comment 3 above, as presented in lines 223-236 of the manuscript.

Reviewer #2

Reviewer #2 Comment 1 (comment 13): Thank you for the opportunity to review this paper. This under researched group of educators presents an exciting opportunity to research the potential of preservice educators to influence the physical activity behaviours of youth.

Author response 13: Thank you for your support of our research.

Reviewer #2 Comment 2 (comment 14): What is a core unit of instruction?

Author response 14: A core unit is a compulsory unit of work or a subject that all Bachelor Education (Primary) students (preservice teachers) have to complete. Thus, it is not an elective but rather a core component of the degree. More information around the core unit (i.e., Introduction to Curriculum and Pedagogy) has now been included as recommended. Please see above our amendments in response to Reviewer #1 Comment 7, and lines 186-191 of the manuscript.
In addition, further information around how Transform-Ed! was embedded into the curriculum and pedagogy unit is provided in Table 1 (lines 219 of the manuscript) and in lines 205 - 216 of the manuscript. Please see response to Reviewer # 1 Comment 4 above.

Reviewer #2 Comment 3 (comment 15): What is Transform-Ed? What is Transform US? Please fully explain these initiatives.

Author response 15: Transform-Us! is a program which promotes primary school-children’s physical activity throughout the day through a mix of environmental, pedagogical, educational and behavioural strategies. Part of the program delivery involves professional development of in-service teachers. Transform-Ed! has adapted the key elements of the Transform-Us! program and has infused it into the teacher education undergraduate degree targeting pre-service teachers. This explanation has now been incorporated in the manuscript in response to Reviewer # 1 Comment 4 as well as new text shown below:

Introduction, lines 87-92:

(Transform-Us!)

Transform-Us! (17) was a successful 18-month, four-arm cluster-randomized controlled trailed in 20 primary (elementary) schools, with over 220 teachers and 1600 students, in Melbourne, Australia. The study aimed to increase children’s physical activity and decrease sedentary behavior across the school day by incorporating a mixture of educational, pedagogical, behavioural and environmental approaches in order to integrate movement into everyday class lessons, recess/lunchtime and homework (17). Results demonstrated numerous positive student outcomes such as reduced sitting, increased moderate-to-vigorous physical activity, and lower body mass index, waist circumference and systolic blood pressure (18). In collaboration with the Department of Education and Training, it is currently being offered at scale to all primary schools across the state of Victoria in Australia.

Study aim: Introduction, lines 112-115:

(Transform-Ed!)

Therefore, the objective of this pilot study was to test the feasibility and potential impact of embedding evidence-based active pedagogy (Transform-Ed!), based on an adapted version of the efficacious Transform-Us! program, into one core unit of an undergraduate teacher education degree.

In addition, further information has been provided around Transform-Ed! (i.e., an adapted version of the efficacious Transform-Us! RCT, targeting pre-service teacher education). Please see below, as shown in lines 195-218 of the manuscript:

The Transform-Ed! intervention content was guided by the original Transform-Us! content, which was framed by social cognitive theory (24), behavioral choice theory (25) and ecological systems theory (26). An overview of the theoretical basis of the adapted version of Transform-Us! intervention (i.e., Transform-Ed!) and links to program objectives are presented in Additional file 1. In brief, these theories (i.e., social cognitive theory (24), behavioral choice theory (25) and ecological systems theory (26)) have previously been shown to be effective in encouraging behaviour change in children's physical activity and sedentary behaviour. They recognize that there are multiple levels of influence on health behaviour including intrapersonal (e.g., awareness, self-efficacy, enjoyment), interpersonal (e.g., parents & teachers), physical environmental (e.g., classrooms and playgrounds), and policy influences
(e.g., school and classroom policies). In light of this, the Transform-Ed! intervention content included learnings around three key areas, namely: (i) classroom-based physical activity/active teaching (e.g., physically active academic lessons, active breaks, health-based curriculum content); (ii) active environments (e.g., encouraging activity at recess and lunchtime); and (iii) active families (e.g., engaging families via active homework). The key messages were disseminated to pre-service teachers, by the academic educators, in the following ways: modelling active teaching and active breaks throughout lecture and seminars; providing the theoretical underpinnings of the importance of physical activity in lectures; delivering education around pedagogies that are designed to promote activity; facilitating peer micro teaching opportunities, whereby the pre-service teachers practice active teaching strategies and receive peer and lecturer feedback in seminar sessions; and; providing comprehensive resources on active teaching, active breaks and active homework examples.

Reviewer #2 Comment 4 (comment 16): What are primary teachers? grades etc? specialists? generalists?

Author response 16: Primary teachers, are generalist classroom teachers of primary school or elementary school students. Students at primary schools are generally between the ages of 5 (foundation) and 12 years (year 6).

This has been clarified on lines 128-129 as shown below:

Bachelor of Education (Primary) pre-service teachers (i.e. generalist elementary pre-service teachers of children between the ages of 5 and 12 years).

Reviewer #2 Comment 5 (comment 17): Line 68: The authors take a leap from the low levels of children to the importance of schools. Please note that schools play a part in the activity behaviours of youth, but just a part.

Author response 17: Thank you for your suggestion here, the authors acknowledge your point, and this section has been amended to reflect your suggestion. Please see lines 77-79 of the manuscript and below:

Schools can play a part in the activity behaviours of youth, as they have access to most children regardless of race, ethnicity or socioeconomic status, and for many hours on weekdays (16).

Reviewer #2 Comment 6 (comment 18): More information is needed about Transform Us. Comment 18a: Is this initiative being conducted successfully in schools? If so, what facilitators and barriers are being reported?

Author response 18a: Further information has been provided around Transform-Us!, please see lines 87-92 of the manuscript and below:

Transform-Us! (17) was a successful 18-month, four-arm cluster-randomized controlled trial within primary (elementary) schools in Melbourne, Australia aiming to increase children’s physical activity and decrease sedentary behavior across the school day, to optimise health outcomes. The study incorporated a mixture of educational, pedagogical, behavioural and environmental approaches in order to integrate movement into everyday class lessons, recess/lunchtime and homework (17). Results demonstrated numerous positive student outcomes such as reduced sitting, increased moderate-to-vigorous physical activity, and lower body mass index, waist circumference and systolic blood pressure
In collaboration with the Department of Education and Training, it is currently being offered at scale to all primary schools across the state of Victoria in Australia.

Comment 18b: Were the results from the implementation of this initiative in schools considered in the work conducted with pre-service educators reported in this study?

Author response 18b: The original Transform-Us! program was a 4-arm trial that compared the effects of reducing children’s sitting only, to promoting PA only, to a combination of the two, versus usual practice. From the findings we have focused only on the combined approach (PA and sedentary behaviour), and have adapted the program to be suitable for pre-service teacher education, in lectures and seminars. Thus, much of the Transform-Us! research was used to design and frame the adapted version targeting pre-service teacher education (i.e., Transform –Ed!). This is explained in the manuscript in lines 195-218, as shown below:

The Transform-Ed! intervention content was guided by the original Transform-Us! content, which was framed by social cognitive theory (24), behavioral choice theory (25) and ecological systems theory (26). An overview of the theoretical basis of the adapted version of Transform-Us! intervention (i.e., Transform-Ed!) and links to program objectives are presented in Additional file 1. In brief, these theories (i.e., social cognitive theory (24), behavioral choice theory (25) and ecological systems theory (26)) have previously been shown to be effective in encouraging behaviour change in children's physical activity and sedentary behaviour. They recognize that there are multiple levels of influence on health behaviour including intrapersonal (e.g., awareness, self-efficacy, enjoyment), interpersonal (e.g., parents & teachers), physical environmental (e.g., classrooms and playgrounds), and policy influences (e.g., school and classroom policies). In light of this, the Transform-Ed! intervention content included learnings around three key areas, namely: (i) classroom-based physical activity/active teaching (e.g., physically active academic lessons, active breaks, health-based curriculum content); (ii) active environments (e.g., encouraging activity at recess and lunchtime); and (iii) active families (e.g., engaging families via active homework). The key messages were disseminated to pre-service teachers, by the academic educators, in the following ways: modelling active teaching and active breaks throughout lecture and seminars; providing the theoretical underpinnings of the importance of physical activity in lectures; delivering education around pedagogies that are designed to promote activity; facilitating peer micro teaching opportunities, whereby the pre-service teachers practice active teaching strategies and receive peer and lecturer feedback in seminar sessions, and; providing comprehensive resources on active teaching, active breaks and active homework exemplars.

In addition, the need test the feasibility and potential impact of embedding evidence-based active pedagogy (Transform-Ed!), based on an adapted version of the efficacious Transform-Us! program, into one core unit of an undergraduate teacher education degree, is presented in the manuscript (lines 98-111), please refer to the authors response to Reviewer # 1 Comment 2 above.

Reviewer #2 Comment 7 (comment 19): 5. What is meant by active teaching (line 106)?

Author response 19: Active teaching is now further defined and explained in several parts of the manuscript, as presented below:

Lines 82-86
Approaches to maximize children’s daily physical activity are therefore vital, such as classroom-based physical activity (i.e., active teaching) (7) including active lessons (e.g., learning maths by stepping or
jumping), active breaks (e.g., ‘stand and discuss three key things you have just learned’) or activity content (e.g., lessons on physical activity skills or knowledge).

Lines 205-210
The Transform-Ed! intervention content included learnings around three key areas, namely: (i) classroom-based physical activity/active teaching (e.g., physically active academic lessons, active breaks, health-based curriculum content); (ii) active environments (e.g., encouraging activity at recess and lunchtime); and (iii) active families (e.g., engaging families via active homework).

Furthermore, active teaching is unpacked more comprehensively, including the provision of definitions, elaborations and examples for all elements of active teaching (i.e. active academic lessons, active breaks from sitting, Transform-ED! Health lesson curriculum content, active environments/promoting activity during recess and lunchtime active environments and engaging families). This detail is presented from lines 219 of the manuscript, in Table 1: Examples of how Transform-Ed! key messages and active teaching strategies were embedded into the ‘Introduction to Curriculum and Pedagogy’ Unit of the Bachelor of Education (Primary) Degree

Reviewer #2 Comment 8 (comment 20): What is meant by an "academic educator"?

Author response: This is now explained more clearly in the manuscript in lines 145-146, as shown below:

Academic educators (i.e. tutors and/or lecturers responsible for the delivery of the curriculum and pedagogy unit, the target unit for the Transform-Ed! program)...

Reviewer #2 Comment 9 (comment 21): The intervention was delivered to all pre-service educators but only some consented to participate in the research?

Author response 21: Yes that is correct. The intervention was delivered to all pre-service teachers enrolled in the core unit, ‘Introduction to Curriculum and Pedagogy’ (n=300), as presented on Lines 135-136 of the manuscript. All students consented to being involved in the program, however some were either absent or did not provide consent for either or both surveys (i.e. baseline or follow-up). Specifically, 25 pre-service teachers were absent on the day of baseline surveys, 19 did not consent to baseline survey data collection, 36 were absent on the day of follow up data collection and 2 did not provide consent for follow up survey data collection. This has been clarified in lines 143 of the manuscript.

This participant drop off was presented in the original version of figure 1 provided in the submitted manuscript; however, the figure has now been amended to reflect changes as per comment 22 below.

Reviewer #2 Comment 10 (comment 22): The author is advised to change the participant flow chart to reflect the number of participants who consented 9.

Author response 22: Thank you for your recommendation. The figure has been amended to reflect only consenting participants, as seen at lines 168 of the manuscript.

Reviewer #2 Comment 11 (comment 23): Lines 156 -162 discusses some theoretical underpinnings of Transform Ed, but few examples are provided as to how this theory was put into practice.
Author response 23: The theoretical underpinnings of Transform-Ed! have now been elaborated on considerably as presented in the manuscript in lines 195-218, please refer to the authors response Reviewer #2 Comment 6 (comment 18b above).

In addition, The theoretical basis of the adapted version of Transform-Us!, (i.e., Transform-Ed!) and links to program objectives are presented in Additional file 1 (see below), and referred to in text (please see author response to Reviewer # 2 Comment 18b above),

Additional file 1: The theoretical basis of the adapted version of Transform-Us!, (i.e., Transform-Ed!) and links to program objectives

# Please note this is presented in a tabulated format - however formatting is lost in the automated response to reviewer box.

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Determinants</th>
<th>Program Objectives</th>
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| (i.e., education of pre-service teachers, providing knowledge, skills, and strategies to…)
| Intrapersonal   | Confidence   | Self-efficacy      |
|                 | Preference   | Improve primary students’ confidence in ability to be active or reduce sedentary time |
|                 | Enjoyment    | Increase students’ enjoyment and preference for physical activity |
|                 | Expectations | Benefits/barriers  |
|                 | Expectancies | Increase students’ knowledge of benefits & strategies to overcome barriers |
|                 | Skills       | Self-management    |
|                 | Behavioral   | Facilitate students’ self-rewards, self-instructions in factors around physical activity and sedentary behaviour (e.g., TV viewing styles) |
|                 | rehearsal    | Behavioral rehearsal |
|                 | Self-monitoring & contracting | Assist students with goal setting, contracting with others, rewards |
| Interpersonal   | Observational learning | Modelling |
|                 | Modelling    | Model active teaching in all aspects of teaching, |
|                 | Encourage parents & siblings to reduce their own SB & increase PA via active homework tasks |
| Social support  | Modelling/social support | Encourage parents & siblings to support child to spend less time in SB & more time in PA (active homework) |
| Teachers encourage/support PA during recess/lunch |
| Social structure | Rules | Newsletters, block, parent information sessions to assist parents in enforcing rules regarding limiting screen time at home, during meals, during daylight hours |
| Environmental   | Availability | Increase the amount of PA equipment available at school (lunch/recess/classroom) & home |
|                 | Assist parents or increase parent knowledge (e.g., newsletters, blogs, parent evenings, homework) around reduction of the availability of TVs/computers/electronic games at home |
| Imposed environment | Access | Increase access/opportunities for PA at school & at home. Decrease access to TV/computers/electronic games at home. |
|                 | Policy       | Establish class rules around compulsory interrupted sitting during class-time; ensure there is a presence of supervising teachers during recess/lunch to encourage activity |

* Adapted from Salmon et al 2011. Based on social cognitive theory (24), behavioral choice theory (25) and ecological systems theory (26)

Reviewer #2 Comment 12 (comment 24): Was the pre-service teacher survey pilot tested?
Author response 24: The survey used was a modified version of the Morgan and Hansen survey (2008), which was originally used to assess pre-service teachers’ competency to deliver Physical Education classes. In that study, the questionnaire was pilot tested with primary school pre-service teachers, who answered questions on their previous school practicum PE experiences. This detail has been included in the manuscript at lines 256.

In the current pilot study, a sub sample of pre-service teachers completed the survey for a second time, 1-week post baseline, in order to assess the reliability of the modified version of the Morgan and Hanssen (2008) survey. Specifically, there was a question at the end of the baseline survey asking whether they would be willing to complete the same survey one week later. Those students who accepted the invitation for a repeated measure were re-tested the following week, and that data was analysed for the purpose of survey reliability. To assess test–retest reliability, absolute agreement intraclass correlation coefficients, using two-way mixed models, were calculated for the total score of each construct. The results showed that the questionnaire was highly reliable for total scores of all constructs [ICC range = 0.89–1.00; 95% CI range 0.85–1.00]. The results from this pilot study, including data around the psychometric properties of the survey, will be used to inform the development of a future definitive Transform-Ed! trial. This detail is presented in the manuscript at lines 297-299, in the results section at 335-338 and Table 2.

Reviewer #2 Comment 13 (comment 25): Line 216  Did any participants request changes after reading their transcripts?

Author response 25: No participant requested changes to the transcript. This information has now been included in the manuscript at lines 291.

Reviewer #2 Comment 14 (comment 26): Line 230 - 238.  Please describe how you used this coding procedure with your data.

Author response 26: Information around the coding procedure is provided in lines 303-312 of the manuscript, as shown below:

Specifically, a systematic data analysis process to generate categories and explanations, and thus produce the best qualitative evidence, was conducted (32, 33). Firstly, interview transcripts were reviewed multiple times to facilitate data immersion. Open coding was conducted on all interview transcripts. Descriptive labels were written in the transcript margins, prompting systematic judgments about each segment of text within the data set. As the topics evolved, new codes were added and existing codes were revised and refined to ensure depth and validity of the analysis process. The labels that shared like/similar values or relationships were sorted into clusters, creating categories or themes, which facilitated interpretation of response patterns (32).

Reviewer #2 Comment 15 (comment 27): The inclusion of principals in this study is puzzling as these pre-service educators are not currently working with principals. Were the principals reflecting upon the impact of Transform Us with their current staff.

Author response 27: As this study was a pilot feasibility study, the perceptions of key decision makers (senior academics) and stakeholders (principals) form an integral component of the design and thus the findings, in order to ascertain the potential for the pilot study to be considered for the progression from pilot to a definitive trial. Therefore, engagement with these key stakeholders in the early stages of
research (e.g., pilot or feasibility research) is not only encouraged, but integral. Their engagement and perception forms an iterative process of the research whereby the researcher is actively ascertaining the knowledge, experience and perceptions of direct interest groups (i.e. decision makers and stakeholders), for the purpose of creating a shared understanding, and making relevant, transparent and effective decisions around the progression and future development of the research. Therefore, the results arising from the FGs and interviews are fundamental and highly influential in regard to its perceived feasibility and the progression of this research from pilot to trial.

Further information around the inclusion of the principals has now been included, as recommended. Please refer to lines 159-167 of the manuscript, as shown below:

Principals of primary (elementary) schools within a 15 km radius of the university were invited, via email invitation, to participate in telephone interviews. These primary schools are frequently used as placement schools for the pre-service teachers, and are potential employers of university graduates. The principals form a relevant and important group of stakeholders, who can provide researchers with real-world information they need to develop programs to facilitate implementation and subsequent compliance. The school-based stakeholders (i.e., Principals) were interviewed to identify program feasibility as well as the potential real-world relevance and impact of hosting placement teachers or employing graduate teachers trained in active pedagogy.

Reviewer #2 Comment 16 (comment 28): Line 348: More evidence is needed to support the assertion that pre-service educators can influence change from the "ground up". In many cases pre-service educators are not on the ground as little attention is paid to their thoughts etc, they are usually expected to conform to their supervisors practices To suggest that pre-service educators can influence change in an educational system may be a stretch. Do you have literature to support this assertion?

Author response 29: There is comprehensive literature around the impact of pre-service teacher education on teacher effectiveness. However, due to the scope of the journal, this information and references have to be considerably condensed. In response to your comment however, the authors have provided further support for the influence of pre-service teacher education on teacher’s effectiveness in the manuscript, including the key supporting references. Please see lines 103 - 111, as shown below:

Pre-service teacher education programmes aim to prepare graduates to become quality teachers equipped with pedagogical practices that will serve to meet the increasing demands associated with the teaching profession (21). Indeed, pre-service teacher education provides an integral platform for scaffolding critical pedagogical skills, strategies, knowledge and capabilities (22), and as such is viewed as a crucial link in producing quality teachers, and more positive student outcomes (21). The impact of pre-service teacher education on teacher effectiveness and student outcomes is internationally recognised as pivotal (22), yet it is an under-studied and perhaps under-utilised setting for physical activity and sedentary behaviour intervention research.

However, by no means are the authors suggesting that pre-service teacher education will solve the issue of low levels of physical activity, nor will it be solely responsible for education reform. What we are investigating is whether or not educating our future teachers, at the inception of their teacher education, around active pedagogy is feasible, and exploring the potential impact this may have in the future. Our planned future trials will then determine the effectiveness and impact of Transform-Ed! on primary school students’ physical activity and sedentary behaviour, as well as the impact it has on educational change.
Reviewer #2 Comment 17 (comment 29): Please discuss the lack of understanding of the importance of movement implied in the comments by the academic educator in line 301. impede learning objectives? Discuss the benefits of movement on learning. This seems to have been missed by this academic. And by the principal as evidenced by their comment in line 410. Time waster?

Author response 29: Ascertaining and unpacking responses such as these are critical for better understanding the major barriers and facilitators to program implementation, adherence and fidelity. As mentioned, the engagement and perception of principals (Stakeholders) and senior academics (decision makers) forms an iterative process of the pilot research whereby the researcher is actively ascertaining the knowledge, experience and perceptions of direct interest groups, for the purpose of creating a shared understanding, and making relevant, transparent and effective decisions around the progression and future development of the research. In this situation, the lack of understanding or knowledge of principals (stakeholders) and senior academics (decision makers) around active teaching and the benefits of movement, and their perceptions that active teaching may impede learning, provides researchers with direction and an avenue to intervene. Specifically, in the development of the future trial, comprehensive education, knowledge and information will be shared with these key players to enhance their understanding around active teaching and potentially negate the misunderstanding shared by this principal and academic.

This has been included in lines 568-573 of the manuscript, as shown below:

Early and active involvement of key stakeholders (i.e., principals) and decision makers i.e., (senior academics) provides researchers with a better understanding of the perceived barriers and facilitators to program feasibility, implementation, adherence and fidelity in real-world contexts. This understanding informs future intervention development, and may increase intervention sustainability (44) and lead to improved engagement and involvement over time (45).

Reviewer #2 Comment 18 (comment 30): 16. Has the impact of Transform US been measured?

Author response 30: Yes, the impact of Transform-Us! has been measured. Mid intervention results are published and were included in the manuscript (lines 92-98). The post intervention results are impressive and the paper is currently under revision. In brief, the results included: 62 minute reduction in sitting time per day compared to traditional lessons, 5 minute increase in moderate to vigorous physical activity per day, lower Body Mass Index (BMI), waist circumference and systolic blood pressure and higher vitamin D levels, 85% student increase in concentration, and79% increase in students’ time on task, compared to control. In collaboration with the DET, The National Health and Medical Research Council and VicHealth have now funded a scale-up of the program to all primary schools in Victoria.