Development of the MAT-PE

Methods

A team of cross-disciplinary researchers ([redacted]) from across fields of PE, SDT, sport and exercise psychology, PA, motor control and pedagogy (for more detail please see main manuscript) took part in a series of interactive meetings to co-produce a measure of motivation in PE in young children, from the theoretical framework of SDT. The aim was to develop a tool with a mixed-method approach as young children can be difficult to work with, adopting an "what works best" approach to answer this research problem (Creswell & Plano Clark, 2011).

The development of the MAT-PE involved 43 children aged 5-6 years old (54% male) from three primary schools. Data was collected using structured interviews involving a set of activities which explored young children's reasons for taking part in PE, satisfaction of the three basic psychological needs (relatedness, autonomy and competence) and the different types of regulations (see Table 1 below for the initial set of activities within the MAT-PE). These activities involved selection tasks (quantitative) followed by open-ended questions to ascertain why (qualitative). Initial content validity was established by consensus amongst the research team that each item accurately represented the relevant SDT construct and were judged to be understandable to children.

Participants

Following written informed head teacher and parental consent and child verbal assent to take part in the study, a convenience sample of 43 participants (aged 5-6, male=54%) from two reception and three year 1 classes within three primary schools situated in [redacted] took part in the development of the tool. Children were purposively selected by class teachers on the basis of having sufficient skills in speaking and listening in English and feeling comfortable to talk with a visitor. This inclusion criteria were deemed necessary due to the high propensity of migrant children within the schools who may not have any English language skills.

Procedure

Development, testing and redesigning of the tool took place over three weeks across three primary schools. Following training by the first author, the MAT-PE was administered by members of the research team ([redacted]) with prior experience of working with children and SDT knowledge. Multiple research team members administered the tool in order to obtain a larger sample size however each research team member was given a script to follow so as to minimise between-subject effects. Description of the first version of the tool (version 0.1) can be seen in Table 1. The first activity involved the whole class of children (*Draw a picture of why you take part in PE*) whereas only a convenience sub-sample of research study participants (n=43) completed the rest of the tool (need satisfaction and behavioural regulations) on a 1:1 basis with a researcher. Children's responses whilst completing the activities were audio recorded via Dictaphone.

Throughout this development period and at the end of each testing day, the MAT-PE administrators met as a group and discussed the content validity of the tool, how the children had responded to the activities and any necessary changes to both the tool content and the administration. Notes were taken by the lead author to document these discussions.

Results

The MAT-PE was developed over a period of three weeks with 43 children. The initial MAT-PE (version 0.1) took around 15 minutes to administer (excluding the classroom-based drawing) and went through multiple iterations during the development phase (see Appendix A). For example, changes were made to wording (e.g. most children did not understand what 'guilty' meant for the introjected regulation choice); picture resources (e.g. the autonomy sorting activity had the pictures for PE equipment and group work separated to gather more detail around the amount of choice the children felt they had); type of activity (e.g. the competence activity changed from a Visual Analogue Scale to a five-star star-chart as children were inconsistent with their placements along the 10cm line); and the

meaning behind the activity (e.g. the relatedness activity changed from a quantity [how many friends] to a quality [feeling of inclusion/exclusion] activity).

A final pilot of the tool was administered two children (m=50%) as data collection finished at the end of the school year. The tool took approximately 20 minutes to administer (excluding the classroom drawing activity), depending on the amount the children talked. These two children responded well to all activities. For example: both children understood the 1-5-star 'chart' within the competence activity and were able to articulate reasons for their score; separating the autonomy choices into individual pieces of PE equipment and peer selection led to more sensitivity in the choices the children felt they had within PE; and both children were able to provide coherent and relevant answers to the follow-up questions given for each chosen type of behavioural regulation, including introjected (where the stem had been changed to *I do PE because I want my PE teacher and classmates to like me*). The research team determined by consensus that this iteration of the tool elicited enough depth and understanding from the children around their motivational perceptions to show promise of content validity, though it was deemed necessary to further trial MAT-PE version 1 with a larger sample of young children to confirm these assertions.

Table 1

Description of the MAT-PE version 0.1

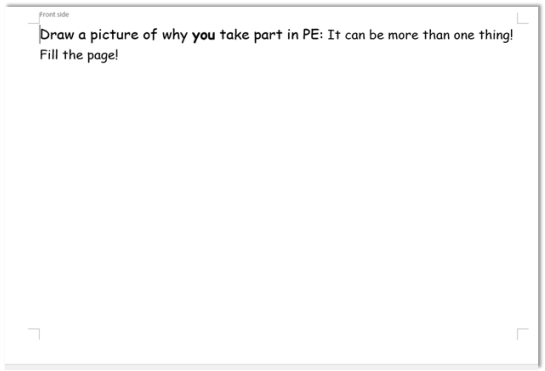
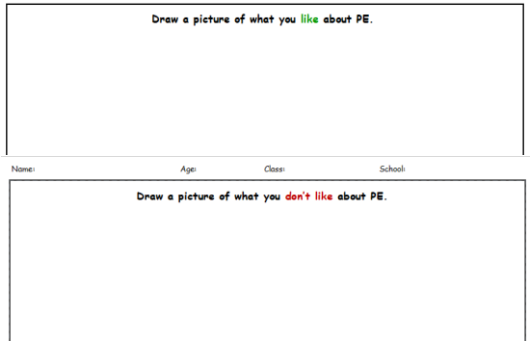
Construct	Activity	Description	Rationale
		Whole class activity	
PE participation part 1	Draw and Write	Children were given 30 minutes to draw a picture of why they take part in PE.	Informed by Write and Draw, and Write, Draw, Show and Tell procedure (Porcellato et al. 2005; Noonan et al. 2016).
		One-to-one activities completed with a researcher	
Icebreaker	Pair-matching card game	A memory game where the child needed to match pairs of PE-themed cards. The child was asked to turn over one card and try to find the matching card.	Activity was utilised to build rapport between researcher and child (Irwin & Johnson, 2005). PE theme was used to integrate with the rest of the activities.
PE participation part 2	Discussion	The child describes to the researcher what they have drawn. The researcher asks probing questions (e.g. who is this? How did you feel? Why were you doing that?) to ascertain depth of responses.	Informed by Write and Draw, and Write, Draw, Show and Tell procedure (Porcellato et al. 2005; Noonan et al. 2016).
Relatedness	Choose and discuss	The child was presented with two sets of two pictures depicting a child (them) and their relationship with either (i) peers (quantity) or (ii) PE teacher. The child was asked to pick the picture that was most relevant to them for each set and explain why they had chosen each picture.	PE teachers and peers have differential effects upon children's relatedness (Vasconcellos et al. 2019) therefore both were included. Activity format based on structured alternative format utilised by Harter and Pike (1984) and Barnett et al. (2015).
Autonomy	Sorting	The child was shown a silhouette and told that it represented them in PE. They were shown two thought clouds (one with PE equipment and one with children) and were asked to place these over the head of the silhouette if they thought that they got to choose those things in PE.	Autonomy is classified into three categories: procedural, organisational and cognitive (Stefanou, Perencevich, Dicintio & Turner, 2004). Procedural (e.g. choice of equipment) and organisational (e.g. peer selection) were included in this development phase.
Competence	Visual analogue scale (VAS)	The child was shown a 10cm VAS with "zero" and "superhero" stems and pictures anchoring each end. The child was asked to mark the line at a point which depicts how good they think they were at things in PE.	While there is conflicting evidence for the suitability of VAS in young children (Shields, Palermo, Powers, Grewe & Smith, 2003), this was trialled as it allows for strength of perception of competence without numbers.
Self-regulation	Choose and sort	The child was shown each type of regulation depicted by a picture from Google and a simplified stem derived from the literature. They were asked to pick their favourite reasons for taking part in PE and then to order them in matter of importance for them.	A picture and stem were produced for each type of regulation based on previous research (identified, Guay et al. 2010; Sebire et al. 2013). Integration was omitted as this type of regulation is thought to emerge in adolescence or adulthood due to its reliance on higher-order reflection capability (Ryan & Deci, 2017). External

regulation was split into 'reward' and 'punishment' as children may feel more affinity with one or the other.

64

Appendix A: Full iteration matrices for each aspect of the MAT-PE

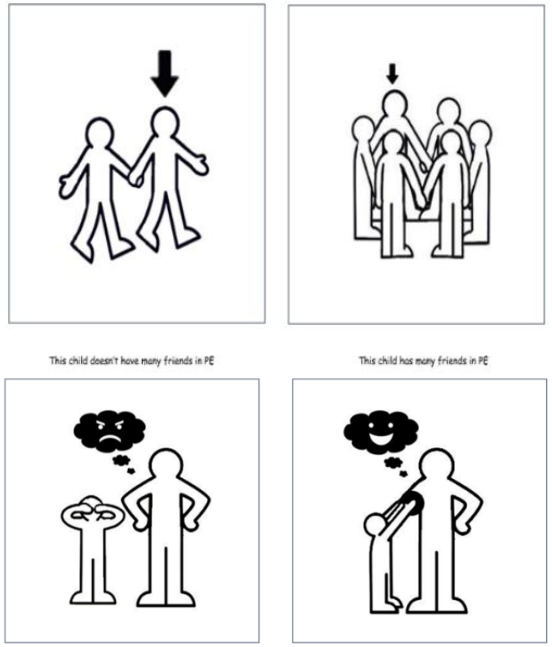
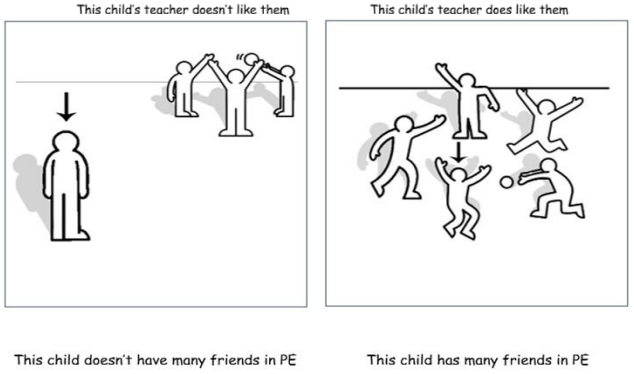
Enjoyment of PE

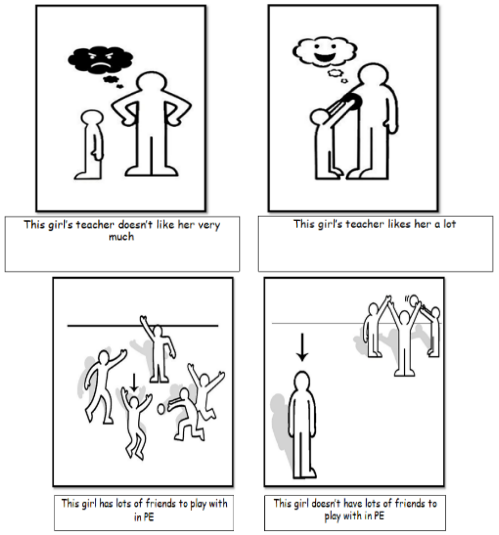
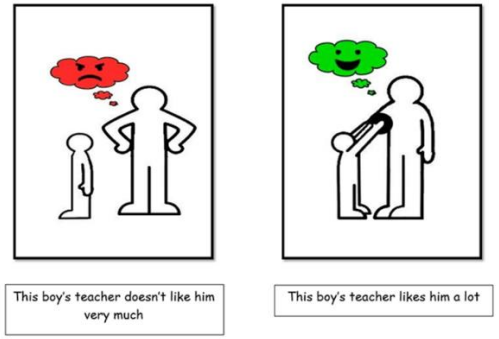
Iteration	Description of iteration	Trialling with children	Resource	Recommended changes
1	An A4 piece of paper with the following instruction at the top of the page: Draw a picture of why you take part in PE: It can be more than one thing! Fill the page!	All children within the sample took part. Pictures varied highly in quality and relevance.		The class teacher highlighted the abstract nature of the task request. Discussions with the expert panel resulted in the task instruction and set-up be changed to a double-sided A4 piece of paper with the instructions: Draw a picture of what you like about PE [one side] Draw a picture of what you don't like about PE [other side]
2	An A4 double-sided piece of paper asked the children to draw a picture of what they like and don't like about PE.	All children within the sample took part. Pictures were of better quality and more relevant to the task instruction.		The research group determined that the instruction was clearer for the children. It was also decided that enjoyment could be determined more directly through this task than through interpretation of pictures through the "why" question in the last version.

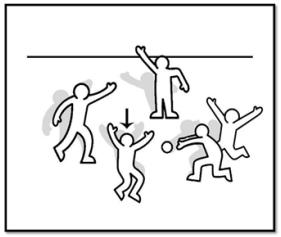
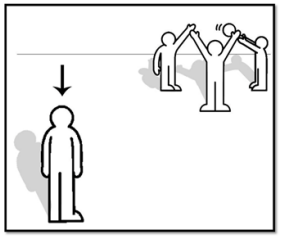
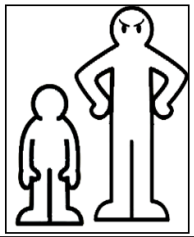
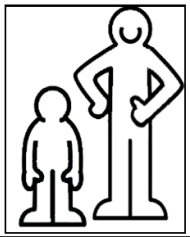
Relatedness Need Satisfaction

Iteration	Description of iteration	Trialling with children	Resource	Recommended changes

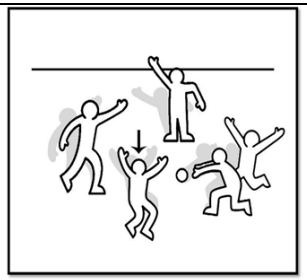
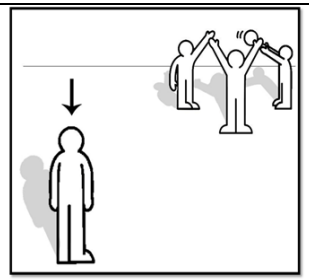
1	A Harter/Barnett type pictorial questionnaire was used with the stems: "When you were in this PE lesson, did your teacher talk to you not talk to you?" "When you were in this PE lesson, did you talk to or work with your friends?"	*Not tried with children.*	N/A	The research group deemed the statements may be too broad and not harness the essence of relatedness.
2	My teacher always helps me in PE- My teacher never helps me in PE My teacher likes me- My teacher doesn't like me My teacher shouts at me in PE- My teacher is nice to me in PE My teacher always helps me to do my best in PE-My teacher tells me off a lot My teacher listens to me in PE- My teacher doesn't listen to me in PE. My teacher cares about me in PE- My teacher doesn't care about me in PE My teacher lets me play with my friends in PE-My teacher doesn't let me play with my friends	*Not tried with children*	N/A	It was suggested that these stems mix between need support and need satisfaction. Further development of these stems was suggested for conceptual understanding and refining of items. It was also suggested that development start upon a peer related item.

3	"This child has many friends to play with in PE/This child doesn't have many friends to play with in PE." "This child's PE teacher likes them/This child's PE teacher doesn't like them." These stems had pictures to go with them so the children would have something to focus on and with which to engage.	*Not tried with children*		Pictures were created for peer relatedness and it was suggested that the pictures be PE specific.
4	The peer relatedness pictures were altered to be more PE specific.	*Not tried with children*		It was suggested to have two separate types of resources (male/female). To avoid extreme language, it was suggested that on the PE teacher relatedness stems it should be changed to "this girl/boy's teacher doesn't like them very much." It was also suggested to contrast the expression clouds on the teacher relatedness pictures.

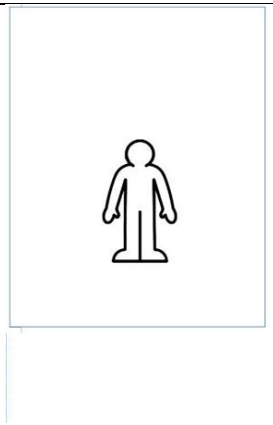
During Phase 1				
Iteration	Description of iteration	Trialling with children	Resource	Recommended changes
5	Pictures were developed for both teacher and peer relatedness items alongside stem development. Teacher expression clouds were coloured black for angry, white for happy.	Through trialling this aspect in three schools, it was necessary to explain the pictures to the children to ensure clarity.		It was suggested that perhaps colour could be used in the teacher relatedness pictures to aid understanding.
6	On the teacher relatedness pictures, the clouds were either red (angry) or green (happy).	Trialling this iteration didn't lead to any marked improvement in understanding on the child's part.		It was suggested that using colour would cause problems for colour-blind children. It was recommended that colour be taken out with the expression to be placed on the teacher's face rather than in the clouds. Conceptual understanding of peer relatedness was developed and it was suggested that the stem be changed but the pictures to stay the same.

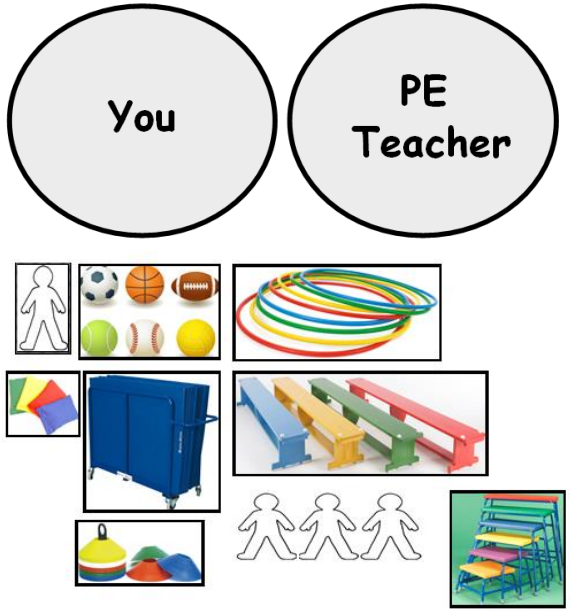
7	Within the peer relatedness pictures, the stem was changed to: "Other children let me play with them in PE." "Other children don't let me play with them in PE." The teacher relatedness pictures were altered and made PE teacher specific within the stem.	*Not tried with children*	 Other children let me play with them in PE.  Other children don't let me play with them in PE.  This girl's PE teacher doesn't like her very much  This girl's PE teacher likes her very much	The stems had changed structurally to initially support the new stem formation so it was suggested to revert back to the old structure to maintain consistency. The PE teacher resource was deemed the final one.

During Phase 2

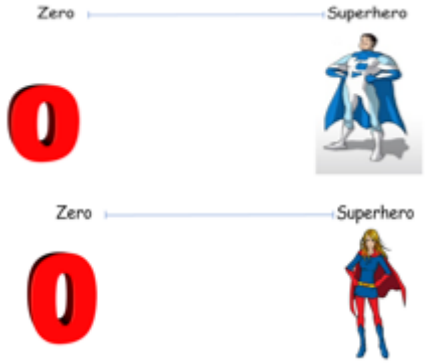
Iteration	Description of iteration	Trialling with children	Resource	Recommended changes
8	The peer relatedness pictures' stems were changed to: "Other children don't let this girl play with them in PE." "Other children let this girl play with them in PE."	The child was first asked what they thought was happening in the pictures. The majority of the children understood what scenario the pictures represented. Confusion was minimised and clarity was gained from their answers.	 Other children let this girl play with them in PE.  Other children don't let this girl play with them in PE.	This iteration was deemed the final one.

Autonomy Need Satisfaction

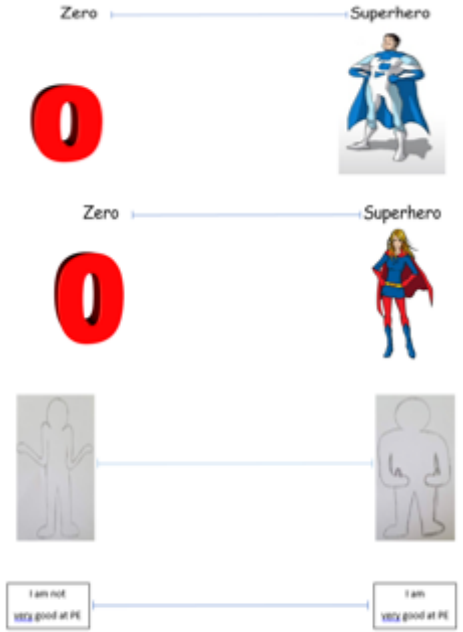
Before Phase 1					
Iteration	Description of iteration	Trialling with children		Resource	Recommended changes
1	Contained questions such as: "How are you feeling in this picture?" (their PE picture) "What is making you feel X?" Why are you doing X?" "Did you feel like you could choose what you wanted to do?" "Did you enjoy being able to choose?"	*Not tried with children.*	N/A		It was put forward to emulate the Harter/Barnett type of two layers of questioning i.e. Option 1 or 2, a lot or not a lot, looking exclusively at need satisfaction.
2	"My teacher lets me choose what to do in PE" or "My teacher tells me what to do in PE." "My teacher lets me choose what we can play in PE" or "My teacher tells us what to play in PE" "I like PE" or I don't like PE."	*Not tried with children.*			It was suggested that this stage needed an activity rather than a list of statements to keep the children engaged and to be consistent with the previous activity.
During Phase 1					
Iteration	Description of iteration	Trialling with children		Resource	Recommended changes
3	Activity changed to be pictorial-based where a picture of a child was placed in front of the child and two thought bubbles were given as choices: one contained different equipment and the other the choice of whether they could choose which friends they worked with during PE.	It was explained that the child silhouette was them in PE. In one thought bubble there were different types of PE equipment. The children were then asked whether they could choose equipment in PE and if so, to move the bubble over the child silhouette. The other bubble was explained that there are children in PE that we might be able to choose to work with in pairs and/or groups and they were asked				It was deemed that although the activity had the children engaged, it may not be giving much detail about the choices they make in PE. Separating the selection of choices further was developed.

		whether they could choose who they worked with. If so, they were to move that bubble over to the child silhouette. They were then asked if they could give an example of when they could choose equipment and/or children.		
		During Phase 2		
Iteration	Description of iteration	Trialling with children	Resource	Recommended changes
4	A plate with "PE teacher" and a plate with "You" was created. A choice of equipment was put together as individual choices so the children could pick which equipment they might choose. Child silhouettes depicting working in pairs and working in groups were also created. After the pictures had been sorted, each child was asked: Do you ever get to choose the activities that you do in PE or does the PE teacher choose for you? Do you ever get to choose how you do the movements or actions in PE or does the PE teacher show you and tell you how to do them? Does your PE teacher listen to you? Does your PE teacher answer your questions?	Children were shown both plates and it was explained that the "you" plate was theirs and the PE teacher plate was for their PE teacher. They were then shown a series of pictures depicting peer working, small equipment and large equipment. They were then asked which things could they choose in their PE lessons and which things they couldn't. Once they'd placed the different pictures in both plates, they were asked if they could recall a time where they got to choose these things and not choose these things. Children were able to answer the follow-up questions.		The activity was broken down so that more detail could be explored around the choices they make within PE and captured organisational and procedural autonomy. Adding these follow-up questions added extra depth to the autonomy construct by adding more cognitive autonomy aspects This was deemed the final iteration.

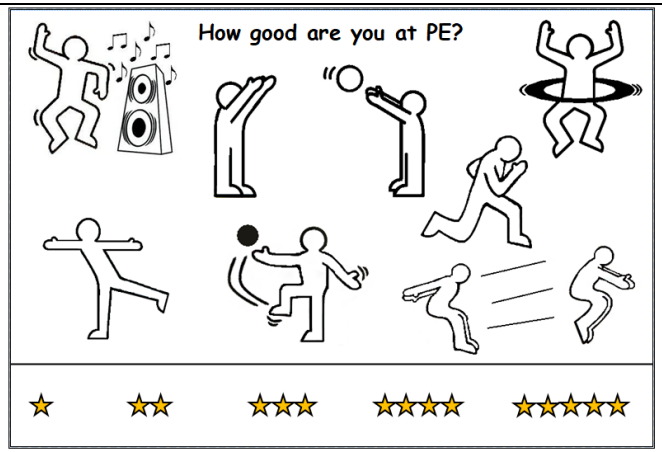
Competence Need Satisfaction

Before Phase 1				
Iteration	Description of version	With children	Resource	Recommended changes
1	A sheet of one-sided paper including a 10cm visual analogue scale, anchored by "zero" (accompanied with a picture of a zero) at one end, and "superhero" (accompanied by a picture of a superhero) at the other. There is a male and female version. "How good are you at PE?" Zero means "not very good" and superhero means "amazing." Child is also told that they may be somewhere in the middle. The child is told to point along the line as to where they think they lie on the continuum. They are then asked "How do you know that you're there on the line?" and "Do you think PE easy or hard, why?"	*Not tried with children.*		"How do you know that you're there on the line?" changed to "Tell me why you have put your mark here."

During Phase 1				
Iteration	Description of version	With children	Resource	Recommended changes
2	The question "How do you know that you're there on the line?" was changed to "Tell me why you have put your mark here."	Children seemed to be drawn to the superhero pictures, regardless of gender, presenting bias towards more positive pictures rather than an attempt at considering competence within PE.	N/A	It was suggested "not too good" and "really good" be used instead of "not very good" and "amazing" to be more in-line with the pictorial scales used in other aspects. *Suggestion was seen too late before administering to children*.

				The research group suggested that other forms of pictures should be used to anchor the visual analogue scale and perhaps a text only version to account for any pictorial bias.
3	Three representations of competence scale were presented to each child (superhero scales determined by gender). The child was given the same procedure but for each one. First being the zero to superhero, second being the unsure picture to thumbs up picture, third being “I am not very good at PE” to “I am very good at PE” in text form only.	Children seemed to give more thought into their responses on the unsure and thumbs up picture line and the text line.		Although the children seemed to think more about their answers before marking the line, they did not understand the concept of the visual analogue scale. It was suggested to try a star rating scale instead.

4	The sheet of paper included pictures of stars from 1 to 5, horizontally along the page. Above 1 star was a picture of an unsure gender/ethnically neutral picture. 2, 3 and 4 stars were shown but without pictures above them. Over 5 stars, a picture of three different children demonstrating different skills was shown. 1 star meant "Some children can't do many things in PE" and 5 stars meant "Some children can do many things very well in PE." The stars in the middle were explained to the child that some children are neither not very good nor very good at things in PE but somewhere in the middle. They were then asked, "How good do you think you are in PE? How many stars would you give yourself? Why?"	Children understood the star system and gave varying answers (indicating sensitivity) with relevant justifications.		It was suggested that the middle stars may need to be represented pictorially with a progression of skills but without biasing the children's answers by giving them examples. All pictures were to be gender and ethnically neutral.
5	Gender and ethnically neutral humanoid pictures were created for each star rating. The 2, 3 and 4 stars were represented by figures juggling progressively more objects to demonstrate that they could do more things in PE. The 5-star representation was changed to a smiling figure with thumbs up.	*Not tried with children.*		It was suggested that the older version of pictures was clearer. To make sure that the gaps between the ratings were clear so that children could pick in between them. After more discussion it was decided to try out displaying different fundamental movement skills

				according to the national curriculum along the top of the page with the star rating along the bottom. Children can look at all the skills involved within Key Stage 1 PE and judge whether they think they are good at them or not and then to give themselves a star rating. This would then be discussed between researcher and child.
		During Phase 2		
Iteration	Description of version	With children	Resource	Recommended changes
6	Gender-neutral figures depicting fundamental movement skills included within the national curriculum for Key Stage 1 along the top. A five-star rating running along the bottom.	Children were asked what each skill was and the vast majority answered correctly. It was explained that a child who could do all of these skills really well all the time would get five stars. A child who could do most things most of the time would get four stars. A child who could do some things some of the time would get three stars. A child who could maybe do a couple of things would get two stars. A child who could maybe do 1 thing would get one star. How many stars would they give themselves for doing things in PE? Why would you rate yourself as		This iteration was deemed most appropriate with full use of follow-up questions to clarify children's and researcher's understanding of what was being said.

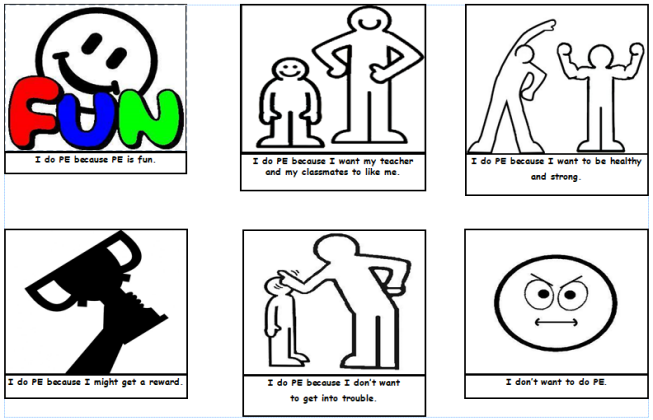
		(5, 4, 3, 2, 1) stars? Some children wanted to give isolated scores for each skill so this was incorporated into the method.		

Behavioural Regulation

During Phase 1				
Iteration	Description of version	With children	Resource	Recommended changes
1	Seven pictures were taken from a Google images search. These pictures were to be used as pictorial representations for each type of regulation on the self-determination continuum. Stems were written based upon selections within self-determination-based questionnaires within PE. Language was simplified to be appropriate for five years old to understand but not necessarily to read.	Each picture and stem were explained to the child one at a time. Introjection contained the word guilt which is a complex emotion therefore when introducing the introjection picture, each child was asked whether they knew what guilty meant. Only one child approached the correct answer therefore it was deemed that in general, five-year olds do not understand the word guilt especially when attributed to not doing an activity. Children were told that each picture represented all the reasons why we might do PE. They were asked to pick their favourite, placing no lower or upper threshold in the amount they chose. From these choices, they were then asked to place them in order of importance.	N/A	Debate was held over whether to keep both positive and negative aspects of external regulation within the method as theoretically they originate from the same psychological principle. However, it was felt to be important to give the children the option of both as they may relate to one but not the other, or both. It was decided that more thought was needed and reading required to theoretically support and inform the stems used.

2	An attempt was made at developing the stems, concentrating on the wording of each.	*Not used with children*		It was advised that more reading was required to fully understand how each stem could fully represent the aspect of regulation in question yet maintaining a simplicity so that children could understand.

During Phase 2

Iteration	Description of version	With children	Resource	Recommended changes
3	Extensive reading led to developed stems alongside a rationale for their inclusion. Pictures were created for the method to maintain consistency across all stages. Amotivation was included through three formats as three exist according to SDT literature.	The method was trialled on two children that included the new pictures, the developed stems, three levels of amotivation and follow up questions based from the SDT literature depending on which reasons they picked. Full method took ~20 minutes per child.		It was deemed that this iteration would provide the most depth in regards to their motivation in PE. It was also decided that only one choice for amotivation should be used and "I don't want to do PE" was retained.

Phase 1: Development of the MAT-PE

Methods

A team of cross-disciplinary researchers ([redacted]) from across fields of PE, SDT, sport and exercise psychology, PA, motor control and pedagogy (for more detail please see main manuscript) took part in a series of interactive meetings to co-produce a measure of motivation in PE in young children, from the theoretical framework of SDT. The aim was to develop a tool with a mixed-method approach as young children can be difficult to work with, adopting an "what works best" approach to answer this research problem (Creswell & Plano Clark, 2011).

The development of the MAT-PE involved 43 children aged 5-6 years old (54% male) from three primary schools. Data was collected using structured interviews involving a set of activities which explored young children's reasons for taking part in PE, satisfaction of the three basic psychological needs (relatedness, autonomy and competence) and the different types of regulations (see Table 1 below for the initial set of activities within the MAT-PE). These activities involved selection tasks (quantitative) followed by open-ended questions to ascertain why (qualitative). Initial content validity was established by consensus amongst the research team that each item accurately represented the relevant SDT construct and were judged to be understandable to children.

Participants

Following written informed head teacher and parental consent and child verbal assent to take part in the study, a convenience sample of 43 participants (aged 5-6, male=54%) from two reception and three year 1 classes within three primary schools situated in [redacted] took part in the development of the tool. Children were purposively selected by class teachers on the basis of having sufficient skills in speaking and listening in English and feeling comfortable to talk with a visitor. This inclusion criteria were deemed necessary due to the high propensity of migrant children within the schools who may not have any English language skills.

Procedure

Development, testing and redesigning of the tool took place over three weeks across three primary schools. Following training by the first author, the MAT-PE was administered by members of the research team ([redacted]) with prior experience of working with children and SDT knowledge. Multiple research team members administered the tool in order to obtain a larger sample size however each research team member was given a script to follow so as to minimise between-subject effects. Description of the first version of the tool (version 0.1) can be seen in Table 1. The first activity involved the whole class of children (*Draw a picture of why you take part in PE*) whereas only a convenience sub-sample of research study participants (n=43) completed the rest of the tool (need satisfaction and behavioural regulations) on a 1:1 basis with a researcher. Children's responses whilst completing the activities were audio recorded via Dictaphone.

Throughout this development period and at the end of each testing day, the MAT-PE administrators met as a group and discussed the content validity of the tool, how the children had responded to the activities and any necessary changes to both the tool content and the administration. Notes were taken by the lead author to document these discussions.

Results

The MAT-PE was developed over a period of three weeks with 43 children. The initial MAT-PE (version 0.1) took around 15 minutes to administer (excluding the classroom-based drawing) and went through multiple iterations during the development phase (see Supplementary Material, Appendix B). For example, changes were made to wording (e.g. most children did not understand what 'guilty' meant for the introjected regulation choice); picture resources (e.g. the autonomy sorting activity had the pictures for PE equipment and group work separated to gather more detail around the amount of choice the children felt they had); type of activity (e.g. the competence activity changed from a Visual Analogue Scale to a five-star star-chart as children were inconsistent with their placements along the

10cm line); and the meaning behind the activity (e.g. the relatedness activity changed from a quantity [how many friends] to a quality [feeling of inclusion/exclusion] activity).

A final pilot of the tool was administered two children (m=50%) as data collection finished at the end of the school year. The tool took approximately 20 minutes to administer (excluding the classroom drawing activity), depending on the amount the children talked. These two children responded well to all activities. For example: both children understood the 1-5-star 'chart' within the competence activity and were able to articulate reasons for their score; separating the autonomy choices into individual pieces of PE equipment and peer selection led to more sensitivity in the choices the children felt they had within PE; and both children were able to provide coherent and relevant answers to the follow-up questions given for each chosen type of behavioural regulation, including introjected (where the stem had been changed to *I do PE because I want my PE teacher and classmates to like me*). The research team determined by consensus that this iteration of the tool elicited enough depth and understanding from the children around their motivational perceptions to show promise of content validity, though it was deemed necessary to further trial MAT-PE version 1 with a larger sample of young children to confirm these assertions.

Table 1

Description of the MAT-PE version 0.1

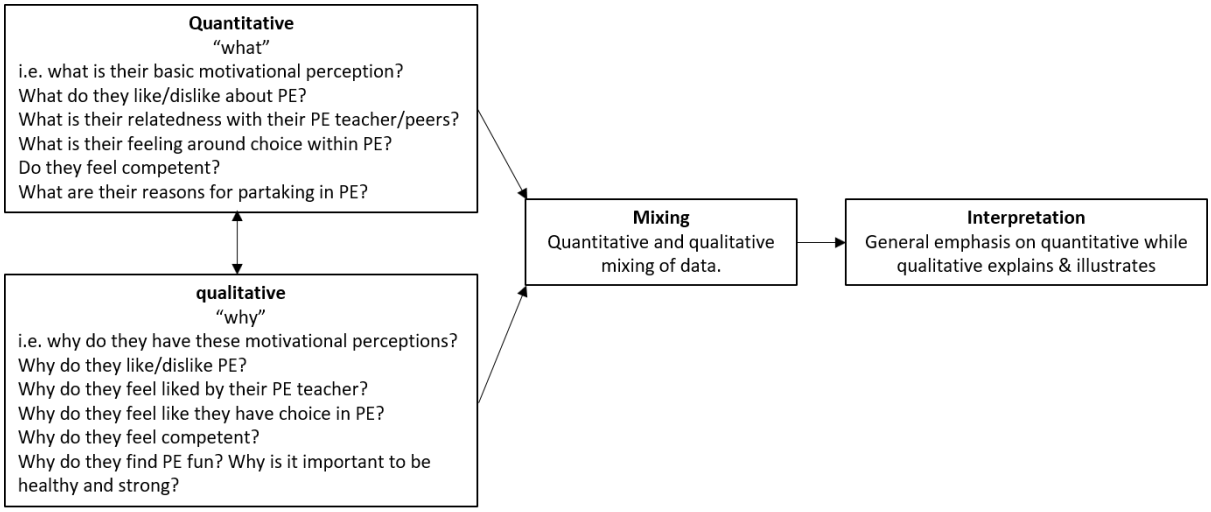
Construct	Activity	Description	Rationale
		Whole class activity	
PE participation part 1	Draw and Write	Children were given 30 minutes to draw a picture of why they take part in PE.	Informed by Write and Draw, and Write, Draw, Show and Tell procedure (Porcellato et al. 2005; Noonan et al. 2016).
		One-to-one activities completed with a researcher	
Icebreaker	Pair-matching card game	A memory game where the child needed to match pairs of PE-themed cards. The child was asked to turn over one card and try to find the matching card.	Activity was utilised to build rapport between researcher and child (Irwin & Johnson, 2005). PE theme was used to integrate with the rest of the activities.
PE participation part 2	Discussion	The child describes to the researcher what they have drawn. The researcher asks probing questions (e.g. who is this? How did you feel? Why were you doing that?) to ascertain depth of responses.	Informed by Write and Draw, and Write, Draw, Show and Tell procedure (Porcellato et al. 2005; Noonan et al. 2016).
Relatedness	Choose and discuss	The child was presented with two sets of two pictures depicting a child (them) and their relationship with either (i) peers (quantity) or (ii) PE teacher. The child was asked to pick the picture that was most relevant to them for each set and explain why they had chosen each picture.	PE teachers and peers have differential effects upon children's relatedness (Vasconcellos et al. 2019) therefore both were included. Activity format based on structured alternative format utilised by Harter and Pike (1984) and Barnett et al. (2015).
Autonomy	Sorting	The child was shown a silhouette and told that it represented them in PE. They were shown two thought clouds (one with PE equipment and one with children) and were asked to place these over the head of the silhouette if they thought that they got to choose those things in PE.	Autonomy is classified into three categories: procedural, organisational and cognitive (Stefanou, Perencevich, Dicintio & Turner, 2004). Procedural (e.g. choice of equipment) and organisational (e.g. peer selection) were included in this development phase.
Competence	Visual analogue scale (VAS)	The child was shown a 10cm VAS with "zero" and "superhero" stems and pictures anchoring each end. The child was asked to mark the line at a point which depicts how good they think they were at things in PE.	While there is conflicting evidence for the suitability of VAS in young children (Shields, Palermo, Powers, Grewe & Smith, 2003), this was trialled as it allows for strength of perception of competence without numbers.
Self-regulation	Choose and sort	The child was shown each type of regulation depicted by a picture from Google and a simplified stem derived from the literature. They were asked to pick their favourite reasons for taking part in PE and then to order them in matter of importance for them.	A picture and stem were produced for each type of regulation based on previous research (identified, Guay et al. 2010; Sebire et al. 2013). Integration was omitted as this type of regulation is thought to emerge in adolescence or adulthood due to its reliance on higher-order reflection capability (Ryan & Deci, 2017). External

regulation was split into 'reward' and 'punishment' as children may feel more affinity with one or the other.

64

Figure 1.

Overview of mixed methods approach within MAT-PE.



Appendix D: MAT-PE Codebook

Motivation Assessment Tool for Physical Education (MAT-PE) Codebook

Table of Contents

Purpose of the Codebook: The Motivation Assessment Tool for Physical Education (MAT-PE) is a mixed-method tool designed to explore self-determined motivation in children aged between five and seven years within a Physical Education context. It also explores children's likes and dislikes around PE, their perceived relatedness, perceived autonomy and perceived competence (outlined in the table below). Knowledge of Self-determination Theory (Ryan & Deci, 2017) is necessary to use this codebook appropriately within the context of Physical Education.

Rationale: When children enjoy a subject and feel that they are good at it their participation in the subject will outlast children who do not enjoy it and do not feel competent in it. Young children start to become more self-aware and begin to compare themselves to others when they reach around eight years of age which can either set themselves upon a spiral of engagement or disengagement (Stodden, Goodway, Langendorfer, Robertson, Rudisill, Garcia & Garcia, 2008). If a child perceives to have autonomy, competence and relatedness (basic psychological needs) within their PE environment then they are hypothesised to have more self-determined motivation than a child who does not (Ryan & Deci, 2017).

Summary: The MAT-PE can be used to explore children's perceptions of their PE environments and the basic psychological needs it provides as well as the level of self-determined motivation they experience. This tool could be used to assess how well PE environments encourage children's basic psychological need satisfaction as well as determining how different motivational climates and teaching styles impact children's self-determined motivation.

Theme	Topic	Activity
Like/Dislike of PE	Strength of like	1a
	Strength of dislike	1b
Relatedness satisfaction	Liked/Disliked by PE teacher	2a
	Like/Dislike of PE teacher	2b
	Inclusion/exclusion by peers	2c
	Inclusion/exclusion of peers	2d
Autonomy satisfaction	Pictorial choices	3a
	Follow-up Question part 1	3b
	Follow-up Question part 2	3c
Competence satisfaction	Overall competence	4
Self-determined motivation	Favourite reasons for partaking in PE	5

Glossary

Action: Whole or part body movements and actions performed by pupils during Physical Education (PE). Actions within the context of this codebook are skill-based and relate to different movements, for example, running, balancing and throwing.

Activity/ies: Games or activities incorporated within a PE lesson that are designed to help pupils meet the learning outcomes. Games or activities can be performed by pupils on an individual basis or in pairs/groups, with or without equipment, and with or without rules.

Articulate: The child verbally responds to the question/prompt from the researcher in a coherent manner where the content of their response corresponds with the question being asked.

Deep level: The child provides detailed information and/or gives coherent examples in their verbal response to posed by questions and/or probes.

Irrelevant response: The child has articulated an answer that is not relevant to the question posed. For example, the researcher may ask, "Why do you like PE?" An irrelevant answer to this question may be, "Because I like playing with Grandpa." As Grandpa does not take part in PE, this is counted as an irrelevant response. If a child provides an irrelevant answer, it is to be coded under surface level response (see surface level).

Movement: The act of moving in a certain way either directed by the teacher (verbally and/or through demonstration) or by the child.

PE Teacher: Within the context of this codebook, the PE teacher is the person delivers the PE lesson to the child's class. This person could be their class teacher, specialist PE teacher or an external coach.

Surface level: The child provides limited or no new information in their verbal response to posed primary questions and/or probes. Responses are generally short, either stating they do not know, or stating that something is the way it is because it is.

Abbreviations

C: Child participant.

N/A: Not applicable. An option which comes under some of the sections within the method. This is chosen when the child has failed to make a choice, whether by pointing to or by verbalising, or because they do not know, even with help from the researcher.

PE: Physical Education.

R: Researcher conducting the method.

Overview of MAT-PE Interview Questions

Theme	Topic	Question(s)	Probes
Likes/Dislikes about PE	Likes about PE	*I asked you to draw a picture of what you like about PE, what have you drawn here?*	Why do you like…?
		You haven't drawn anything, why is that?	
	Dislikes about PE	*I asked you to draw a picture of what you don't like about PE, what you have drawn here?*	*Why don't you like…?*
		You haven't drawn anything, why is that?	
Relatedness	Liked by PE teacher	*This girl's/boy's PE teacher likes her very much, this girl's/boy's PE teacher doesn't like her very much, which girl/boy are you most like?*	*How do you know your PE teacher likes/doesn't like you?*
	Like of PE teacher	*Do you like your PE teacher?*	*Why?*
	Inclusion by peers	*Other children let this girl/boy play with them in PE, other children don't let this girl/boy play with them in PE, which girl/boy are you most like?*	*Can you tell me about a time when other children let you play with them in PE?* *Can you tell me about a time when other children didn't let you play with them in PE?*
	Inclusion of peers	*Do you let other children play with you in PE?*	*Why?*
Autonomy	Pictorial choices	*I've got some pictures here and I want to know which things you get to choose and which things your teacher gets to choose.*	*Can you tell me about a time you got to choose…?* *Do you get to choose this all the time or sometimes?*
	Follow-up question part 1	*Do you ever get to choose the activities you do in PE or does the PE teacher?* *Do you ever get to choose the movements you do in PE or does the PE teacher show you and tell you what to do?*	*Do you/they get to choose all the time or sometimes?* *Do you/they get to choose these all the time or sometimes?*
	Follow-up question part 2	*Does your PE teacher listen to you if you have something to say to them?* *Does your PE teacher answer any questions you might have?*	*Do they listen all the time or sometimes?* *Do they answer your questions all the time or sometimes?*
Competence	Overall competence	*How many stars would you give yourself for doing things in PE?*	*Why would you give yourself…star(s)?*

Self-determined motivation	Regulation type	*Out of all these reasons, which are your favourite reasons for doing PE?*	*<u>Intrinsic:</u>* *Why is PE fun?* *<u>Identified:</u>* *Why is being healthy and strong important to you?* *<u>Introjected:</u> Why is it important that your teacher and classmates like you?* *Do you ever feel like you need to do PE to show other children and teacher how good you are at PE?* *<u>External (reward):</u>* *Do you get rewards in PE?* *What rewards do you get in PE?* *<u>External (punishment):</u>* *If you knew you wouldn't get into trouble, would you still want to do PE? Why?* *<u>Amotivation:</u>* *Why don't you want to do PE?*

<u>Start of codebook</u>

Likes/Dislikes PE | Strength of Liking PE | Activity 1a (Drawing)

Question(s): *I asked you to draw a picture of what you like about PE, what have you drawn here?* **Follow-up question(s):** *Why do you like…? You haven't drawn anything, why is that?*

Code	Description	Example
4	The child has drawn a picture or written words/phrases/sentences on the *liked* side of the drawing activity. The child articulates a **deeper level** response as to why they like PE. *Note.* A child obtains a score of 4 if they provide a deep level response to **at least one** of the pictures they have drawn. The child has not drawn a picture but when asked by the researcher, the child provides a **deep level response**.	R: "Why is it that you like racing?" → C:"'Cos I like to go fast" R: "Why do you like playing football?" → C: "Because we get to learn new stuff that is a little bit hard" R: "Why do you like PE?" → C: "Because I love learning new things."
3	The child has drawn a picture or written words/phrases/sentences on the liked side of the drawing activity. The child articulates a **surface level** response as to why they like PE. *Note.* A child obtains a score of 3 if they only provide surface level responses to **all pictures** drawn.	R: "Why do you like running around cones?" → C: "Because I like running" → C: "Because I just do." → C: "Because I like it."
2	The child has drawn a picture or written words/phrases/sentences on the liked side of the drawing activity. The child does not articulate why they like PE but indicates that the picture is what they like about PE. The child articulates a **surface level or irrelevant response** as to what they like about PE but has not drawn a picture.	R: Why do you like playing football?" → C: Silence R: But you like doing this? → C: "Yes." R: "Why do you like PE?" → C: "Because I do." → C: "Because I like playing with my grandad in the garden."
1	The child has **not drawn a picture or written any words/phrases/sentences** on the liked side of the drawing activity. The child also **does not articulate** a response when the researcher asks if they like anything about PE. The child's drawing or statement indicates that they do not like PE.	R: "Is there anything you like about PE?" → C: "I don't know." R: "Does this picture mean you don't like PE?" → C: Nods head/ "Yes" *(more examples overleaf)*

	The child has drawn nothing but articulates that they don't like PE and provides a reason either surface or deep level as to why they don't like PE.	R: "You haven't drawn anything, why is that?" → C: "Because I don't like PE." R: "Why don't you like PE?" → C: "Because I just don't like it" (surface) → C: "Because I think it's really boring" (deep)

Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):

Likes/Dislikes PE | Strength of Disliking PE | Activity 1b (Drawing)

Question(s): *I asked you to draw a picture of what you don't like about PE, what have you drawn here? Why don't you like…?*
You haven't drawn anything, why is that?

Code	Description	Example
4	The child has drawn a picture or written words/phrases/sentences on the disliked side of the drawing activity. The child articulates a **deeper level** response as to why they dislike PE. *Note.* A child obtains a score of 4 if they provide a deep level response to **at least one** of the pictures they have drawn. The child has not drawn a picture but when asked by the researcher, the child provides a **deep level response.**	R: "Why don't you like running?" → C: "Because I always bump into people and hurt myself." → C: "Because I'm not very good at it." → C: "Because it's boring." R: "Why do you not like PE?" → C: "Because it's too hard."
3	The child has drawn a picture or written words/phrases/sentences on the disliked side of the drawing activity. The child articulates a **surface level** response to why they don't like PE. *Note.* A child obtains a score of 3 if they only provide surface level responses to **all pictures** drawn.	R: "Why don't you like running?" → C: "Because I don't." → C: "I don't know."
2	The child has drawn a picture or written words/phrases/sentences on the disliked side of the drawing activity. The child does not articulate why dislike PE but indicates that the picture is what they don't like about PE. The child articulates a **surface level** or irrelevant response to the researcher's questions but has not drawn a picture.	R: Why don't you like playing football?" → C: Silence R: But you don't like doing this? → C: "Yes." R: "Why don't you like PE?" → C: "Because I don't." → C: "Because my dog always takes the ball away."
1	The child has **not drawn a picture or written any words/phrases/sentences** on the disliked side of the drawing activity. The child also does not articulate a response when the researcher asks if there is anything they don't like about PE. The child's drawing or statement indicates that they like PE. The child has drawn nothing but articulates that they like PE and provides a reason either surface or deep level as to why they like PE.	R: "Is there anything you don't like about PE?" → C: "I don't know." R: "Does this picture mean you like PE?" → C: Nods head/ "Yes" R: "R: "You haven't drawn anything, why is that?" → C: "Because I like PE." *(more examples overleaf)*

		R: “Why do you like PE?” → C: “Because I just like it” (surface) → C: “Because I think it’s really fun” (deep)

Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):

Relatedness Satisfaction| Liked/Disliked by PE Teacher | Activity 2a

Question(s): *This girl's/boy's PE teacher likes her very much, this girl's/boy's PE teacher doesn't like her very much, which girl/boy are you most like?*
Follow-up question(s): *How do you know your teacher likes/doesn't like you?*

Code	Description	Example
4	The child has chosen "liked by teacher" and articulates a deep level response as to how they know that.	R: "How do you know your PE teacher likes you?" → C: "Because sometimes he says good work" → C: "Because she never gets angry at me and she lets me help her" → C: "Because I do good work."
3	The child has chosen "liked by teacher" and articulates a surface level or irrelevant response as to how they know that.	R: "How do you know your PE teacher likes you?" → C: "They just do." → C: "Everyone is supposed to like everyone." → C: "Because I like ice cream." → C: "I don't know."
2	The child has chosen "disliked by teacher" and articulates a surface level or irrelevant response as to how they know that.	R: "How do you know your PE teacher doesn't like you?" → C: "I don't know." → C: "Because I like ice cream." → C: "I don't know."
1	The child has chosen "disliked by teacher" and articulates a deep level response as to how they know that.	R: "How do you know your PE teacher doesn't like you?" → C: "Because he be mean to me" → C: "Because sometimes he says I'm naughty."
N/A	The child has **failed to choose** between the two options and has not articulated toward which choice they feel more affinity with when prompted by the researcher.	The child may choose both or neither to obtain an N/A.

Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):

Relatedness Satisfaction| Like/Dislike of PE Teacher | Activity 2b

Question(s): *Do you like your PE teacher? Why?*

Follow-up question(s): *Why don't you like your PE teacher?*

Code	Description	Example
4	The child has articulated that they like their PE teacher and articulates a **deep level** response as to why.	R: "Why do you like your PE teacher?" → C: "Because they always plan fun games."
3	The child has articulated that they like their PE teacher and articulates a **surface level or irrelevant** response as to why.	R: "Why do you like your PE teacher?" → C: "Because I do." → C: "Because we all have to like everyone." → C: "Because I like ice cream."
2	The child has articulated that they do not like their PE teacher and articulates a **surface level or irrelevant** response as to why.	R: "Why don't you like your PE teacher?" → C: "Because I just don't." → C: "Because I like ice cream."
1	The child has articulated that they do not like their PE teacher and articulates a **deep level** response as to why.	R: "Why don't you like your PE teacher?" → C: "Because they're boring." → C: "Because they make us do hard work and I don't like that."
N/A	The child has **failed to answer** and has not articulated toward which way they feel more affinity with when prompted by the researcher.	The child may choose both or neither to obtain an N/A

Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):

Relatedness Satisfaction| Inclusion/Exclusion by Peers | Activity 2c

Question(s): *Other children let this girl/boy play with them in PE, other children don't let this girl/boy play with them in PE, which girl/boy are you most like?*
Follow-up question(s): *Can you tell me about a time when other children let you play with them in PE? Can you tell me about a time when other children didn't let you play with them in PE?*

Code	Description	Example
4	The child has chosen the "included by peers" option and has articulated a **deeper level** response when prompted for an example.	R: "Can you tell me about a time when other children let you play in PE?" → C: "Last week, Sally and Jimmy let me in their group when Miss told us to get into groups."
3	The child has chosen the "included by peers" option and has articulated a **surface level** response when prompted for an example.	R: "Can you tell me about a time when other children let you play in PE?" → C: "I can't remember anything" → C: "Because I like jelly."
2	The child has chosen the "not included by peers" option and has articulated a **surface** level response when prompted for example.	R: "Can you tell me about a time when other children didn't let you play in PE?" → C: "I don't remember." → C: "Because I like jelly."
1	The child has chosen "not included by peers" and has articulated a **deeper level** response when prompted for example.	R: "Can you tell me about a time when other children didn't let you play in PE?" → C: "Miss told us to get into groups but Bobby and Jimmy wouldn't let me play. → C: "They never let me play."
N/A	The child has **failed to choose** between the two options and has not articulated toward which choice they feel more affinity with when prompted by the researcher	

Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):

Relatedness Satisfaction| Inclusion/Exclusion of Peers | Activity 2d

Question(s): *Do you let other children play with you in PE? Is it important to let other children play with you? Why? Why not?*

Code	Description	Example
4	The child articulates that they include other children either all the time or most/some of the time. They also articulate a **deeper level** response as to why it's important to do this.	R: "Why is it important to let other children play in PE?" → C: "Because if a person is by themselves they won't be able to play by their self like throw the ball by their self."
3	The child articulates that they include other children either all the time or most/some of the time. They also articulate a **surface level or irrelevant** response as to why it's important to do this. The child articulates that they include other children either all the time or most/some of the time and articulates that it's **not important** to let them play.	R: "Why is it important to let other children play in PE?" → C: "Because the teacher makes us." → C: "Because I just do."/ "Because we all do." → C: "Because I like pancakes."
2	The child articulates that they do not let other children play all the time or most/some of the time. They also articulate a **surface level** or irrelevant response as to why they don't.	R: "Why don't you let other children play in PE?" → C: "Because I just don't" / "Because I don't want to." → C: "Because I like pancakes."
1	The child articulates that they do not let other children play all the time or most/some of the time. They also articulate a **deeper level** response as to why they don't.	R: "Why don't you let other children play in PE?" → C: "Because I like to play alone" → C: "Because other children don't let me play so I don't let other children play."
N/A	The child has failed to choose between the two options and has not articulated toward which choice they feel more affinity with when prompted by the researcher.	

Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):

Autonomy Satisfaction| Pictorial Choices in PE | Activity 3a

Choices	Partner	Group	Balls	Beanbags	Cones	Hoops	Mats	Benches	Horses
Tick (if chosen)									

Question(s): *I've got some pictures and I want to know which things you get to choose in PE and which things your teacher gets to choose. Can you tell me about a time you chose…*

Code	Description	Example
6	Child chooses most (>=5 out of 9) of the pictorial choices on their plate and articulates **deep level responses** as examples for them. *Note.* A child obtains a score of 6 if they provide a deep level response to **at least one** of the choices they have picked.	R: "Can you tell me a time you got to choose a ball?" → C: "Miss put all the balls in the middle of the hall and I got to choose mine."
5	Child chooses most (>=5 out of 9) of the pictorial choices on their plate and articulates surface level or irrelevant responses as examples for them. *Note*. A child obtains a score of 5 if they provide surface level or irrelevant responses to **all** choices they have picked.	R: "Can you tell me a time you got to choose a ball?" → C: "I chose the red one." → C: "Last Tuesday." → C: "Because I like trifle."
4	Child chooses some (1-4 out of 9) of the pictorial choices on their plate and articulates **deep level responses** as examples for them. *Note.* A child obtains a score of 4 if they provide a deep level response to **at least one** of the choices they have picked.	R: "Can you tell me a time you got to choose a ball?" → C: "Miss put all the balls in the middle of the hall and I got to choose mine."
3	Child chooses some (1-4 out of 9) of the pictorial choices on their plate and **articulates surface level or irrelevant responses** as examples for them. *Note*. A child obtains a score of 3 if they provide surface level or irrelevant responses to **all** choices they have picked.	R: "Can you tell me a time you got to choose a ball?" → C: "I chose the red one." → C: "Last Tuesday." → C: "Because I like trifle."
2	Child chooses **none** of the pictorial choices and does not articulate examples of the PE teacher choosing them.	R: "Does your PE teacher choose these things all the time or sometimes? → C: "I don't know."

		R: “Can you tell me about a time when your teacher chose the beanbags? → C: “I don’t know.”
1	Child chooses **none** of the pictorial choices and articulates some examples of the PE teacher choosing them. Note. The child can articulate a **deep, surface or irrelevant** response.	R: “Does your PE teacher choose these things all the time or sometimes?” → C: “All the time.” R: “Can you tell me about a time when your teacher chose the beanbags? → C: “Miss handed us each a beanbag and told us to throw as far as we could.” → C: “She chooses all the time.” → C: “I like candy floss.”
N/A	Child **fails to choose** any of the pictorial options for themselves or the teacher.	

Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):

Autonomy Satisfaction| Follow-up Question 1 | Activity 3b

Question(s): *Do you ever get to choose the activities you do in PE or does the teacher?*
Do you get to choose the movements you do in PE or does the PE teacher show you and tell you what to do?

Code	Description	Example
3	The child must perceive that they choose **both** movements and activities either **all the time or sometimes.**	R: "Do you ever get to choose the movements that you do in PE, or does your PE teacher show you and tell you how to do those movements?" → C: "I get to choose." R: "Do you ever get to choose the activities that you do in PE, or does the PE teacher choose? → C: "I get to choose."
2	The child perceives that they choose **either** how to perform movements in PE or if they get to choose the activities they do in PE, either **all the time or sometimes**.	R: "Do you ever get to choose the movements that you do in PE, or does your PE teacher show you and tell you how to do those movements?" → C: "The PE teacher chooses." R: "Do you ever get to choose the activities that you do in PE, or does the PE teacher choose? → C: "I sometimes get to choose."
1	The child perceives that they **never** get to choose how to perform movements in PE and have no choice over the activities they do in PE.	R: "Do you ever get to choose the movements that you do in PE, or does your PE teacher show you and tell you how to do those movements?" → C: "The PE teacher chooses." R: "Do you ever get to choose the activities that you do in PE, or does the PE teacher choose? → C: "The PE teacher chooses."
N/A	The child has **failed to choose** between the two options and has not articulated toward which choice they feel more affinity with when prompted by the researcher.	

Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):

Question(s): *Does your teacher listen to you if you have something to say to them?*		
Code	Description	Example
3	Child clearly answers yes.	R: "Does your PE teacher listen to you if you have something to say to them?" → C: "Yes."
2	Child answers sometimes and may offer an explanation as to why that is.	R: "Does your PE teacher listen to you if you have something to say to them?" → C: "Sometimes."
1	Child clearly answers no.	R: "Does your PE teacher listen to you if you have something to say to them?" → C: "No."
N/A	The child has **failed to choose** between the two options and has not articulated toward which choice they feel more affinity with when prompted by the researcher.	
Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):		

Question(s): *Does your teacher answer any questions you might have?*		
Code	Description	Example
3	Child clearly answers yes.	R: *Does your PE teacher answer any questions you might have?* → C: "Yes."
2	Child answers sometimes and may offer an explanation as to why that is.	R: "*Does your PE teacher answer any questions you might have?* → C: "Sometimes."
1	Child clearly answers no.	R: "*Does your PE teacher answer any questions you might have?* → C: "No."
N/A	The child has **failed to choose** between the two options and has not articulated toward which choice they feel more affinity with when prompted by the researcher.	
Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):		

Competence Satisfaction| Overall Competence | Activity 4		
Question(s): *How many stars would you give yourself for doing things in PE? / Why would you give yourself…stars?*		
Code	Description	Example
9	Child perceives themselves to be 5 stars and articulates a **deep** level response as to why they think this.	R: "Why do you give yourself five stars?" → C: "Because it feels like it's easy peasy and it's not even hard and I can do everything."
8	Child perceives themselves to be 5 stars but articulates a **surface** level response as to why they think this.	R: "Why do you give yourself five stars?" → C: "Because I just am." → C: "Because I like popcorn"
7	Child perceives themselves to be 4 stars and articulates a **deep** level response as to why they think this.	R: "Why do you give yourself four stars?" C: "I'm really good at everything except hula hooping".
6	Child perceives themselves to be 4 stars and articulates a **surface** level response as to why they think this.	R: "Why do you give yourself four stars?" → C: "Because I just am." → C: "Because I like popcorn."
5	Child perceives themselves to be 3 stars and articulates a **deep or surface** level response as to why they think this.	R: "Why would you give yourself 3 stars?" → C: "Because I am good at some of these things." → C: "I'm not too sure."
4	Child perceives themselves to be 2 stars and articulates a **surface** level response as to why they think this.	R: "Why would you give yourself 2 stars?" → C: "Because I just am."
3	Child perceives themselves to be 2 stars and articulates a **deep** level response as to why they think this.	R: "Why would you give yourself 2 stars?" → C: "Because I'm good at running and kicking and maybe balancing but nothing else."
2	Child perceives themselves to be 1 star and articulate a **surface** level response as to why they think this.	R: "Why would you give yourself 1 star?" → C: "Because I just am."
1	Child perceives themselves to be 1 star and articulates a **deep** level response as to why they think this.	R: "Why would you give yourself 1 star?" → C: "Because I'm not good at anything." → C: "Because I'm kind of good at running but nothing else."
N/A	The child has **failed to choose** between the two options and has not articulated toward which choice they feel more affinity with when prompted by the researcher.	
Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):		

	List of choices	Deep or surface/irrelevant responses (D/S)
First choice		
Other choices		
Not picked		

Intrinsic: I do PE because it's fun.

Question(s): *Out of all these reasons, which are your favourite reasons for doing PE? /* **Follow-up question***: Why is PE fun?*

Code	Description	Example
5	**First choice/Deep level** response. Child has chosen intrinsic regulation as their first choice for PE participation and articulates a **deep** level response for the intrinsic follow-up question.	R: "Why is PE fun? → C: "It's fun because we get to play games with my friends." → C: "It's fun because we get to learn new things."
4	**First choice/surface level** response. Child has chosen intrinsic regulation as their first choice for PE participation and articulates a **surface** level or irrelevant responses for the intrinsic follow-question.	R: "Why is PE fun?" → C: "Because it is." → C: "I don't know." → C: "Because I like popsicles."
3	**Other choice /Deep level** response. Child has chosen intrinsic regulation as their other choice for PE participation and articulates **deep** level responses for the intrinsic follow-up question.	R: "Why is PE fun? → C: "It's fun because we get to play games with my friends." → C: "It's fun because we get to learn new things."
2	Other choice /Surface level or irrelevant response. Child has chosen intrinsic regulation as their other choice for PE participation and articulates **surface** level or irrelevant responses for the intrinsic follow-question.	R: "Why is PE fun?" → C: "Because it is." → C: "I don't know." → C: "Because I like popsicles."
1	Not picked	Child does not pick intrinsic regulation

Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):

Identified: I do PE because I want to be healthy and strong.

Question(s): *Out of all these reasons, which are your favourite reasons for doing PE? /* **Follow-up questions***: Is being healthy and strong important? Why is it important to you?*

Code	Description	Example
5	**First choice/Deep level** response. Child has chosen identified regulation as their first choice for PE participation and articulates **deep** level responses for identified regulation.	R: "Why is it important to be healthy and strong?" → C: "It's important to be healthy and strong because you live longer."
4	**First choice/Surface or irrelevant** level response. Child has chosen identified regulation as their first choice for PE participation and articulates **surface** level or irrelevant responses for the identified follow-questions. *Note*. Child also obtains a score of 4 if they state that being healthy and strong is not important.	R: "Why is it important to be healthy and strong?" → C: "I don't know why." → C: "So you can get healthier and stronger." → C: "Because I like candy canes."
3	**Other choice/Deep level** response. Child has chosen identified regulation as their other choice for PE participation and articulates **deep** level responses for identified regulation.	R: "Why is it important to be healthy and strong?" → C: "It's important to be healthy and strong because you live longer."
2	**Other choice/Surface level or irrelevant** response. Child has chosen identified regulation as their other choice for PE participation and articulates **surface** level or irrelevant responses for the identified follow-questions. *Note*. Child also obtains a score of 2 if they state that being healthy and strong is not important.	R: "Why is it important to be healthy and strong?" → C: "I don't know why." → C: "So you can get healthier and stronger." → C: "Because I like candy canes."
1	Not picked	Child does not pick identified regulation

Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):

Introjected: I do PE because I want my teacher and classmates to like me.

Question(s): *Out of all these reasons, which are your favourite reasons for doing PE? /* **Follow-up questions***: Is it important for your teacher and classmates to like you? Why? Do you ever feel like you need to do PE to show other people how good you are at PE?*

Code	Description	Example
5	**First choice/Deep level** response. Child has chosen introjected regulation as their first choice for PE participation and articulates **deep** level responses for the introjected regulation follow-up questions.	R: "Why is it important that they like you?" → C: "It's important that they like me because otherwise I won't have any friends." → C: "It's important that the teacher likes me otherwise I won't get picked to do fun things."
4	**First choice/Surface or irrelevant** level response. Child has chosen introjected regulation as their first choice for PE participation and articulates **surface** level or irrelevant responses for the introjected follow-questions. *Note*. Child also obtains a score of 2 if they state that it is not important for their teacher and classmates to like them.	R: "Why is it important that they like you?" → C: "I don't know why." → C: "Because I like cookies."
3	**Other choice/Deep level** response. Child has chosen introjected regulation as their other choice for PE participation and articulates **deep** level responses for the introjected regulation follow-up questions.	R: "Why is it important that they like you?" → C: "It's important that they like me because otherwise I won't have any friends." → C: "It's important that the teacher likes me otherwise I won't get picked to do fun things."
2	**Other choice/Surface level or irrelevant** response. Child has chosen introjected regulation as their other choice for PE participation and articulates **surface** level or irrelevant responses for the introjected follow-questions. *Note*. Child also obtains a score of 2 if they state that it is not important for their teacher and classmates to like them.	R: "Why is it important that they like you?" → C: "I don't know why." → C: "Because I like cookies."
1	Not picked	Child does not pick identified regulation

Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):

External (Reward): I do PE because I might get a reward.		
Question(s): *Out of all these reasons, which are your favourite reasons for doing PE? /* Follow-up questions*: Do you get rewards in PE? What are they?*		
Code	Description	Example
5	First choice/Deep level response. Child must state what rewards are offered in PE and articulates a deep level response for what rewards they receive in PE.	R: "Do you get rewards in PE?" → C: "Yes." R: "What rewards do you get?" → C: "We get stickers and star of the week.
4	First choice/Surface or irrelevant level response. Child states what rewards they are offered and articulates a surface level or irrelevant response for what rewards they receive. *Note*. Child also obtains a score of 4 if they state that they do not receive rewards in PE.	R: "Do you get rewards in PE?" → C: "Yes." R: "What rewards do you get?" → C: "I don't know." → C: "I like doughnuts."
3	Other choice/Deep level response. Child must state what rewards are offered in PE and articulates a deep level response for what rewards they receive in PE.	R: "Do you get rewards in PE?" → C: "Yes." R: "What rewards do you get?" → C: "We get stickers and star of the week."
2	Other choice/Surface level or irrelevant response. Child states what rewards they are offered and articulates a surface level or irrelevant response for what rewards they receive. *Note.* Child also obtains a score of 2 if they state that they do not receive rewards in PE.	R: "Do you get rewards in PE?" → C: "Yes." R: "What rewards do you get?" → C: "I don't know." → C: "I like doughnuts."
1	Not picked	Child does not pick external (reward) regulation.
Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):		

External (Punishment): I do PE because I don't want to get into trouble.

Question(s): *Out of all these reasons, which are your favourite reasons for doing PE? /* **Follow-up question***: If you knew you wouldn't get into trouble, would you still want to do PE?*

Code	Description	Example
5	**First choice**. Child has chosen external (punishment) regulation as their first choice for PE participation. *Note*. Child **must state no** to the follow-up question.	R: "If you knew you wouldn't get into trouble, would you still want to do PE?" → C: "No" R: "Why?" → C: "Because I wouldn't get into trouble if I didn't do PE." → C: "I don't know why."
4	**First choice**. Child has chosen external (punishment) regulation as their first choice for PE participation. *Note.* Child has said **yes** to the follow-up question and offers a deep or surface level/irrelevant response.	R: "If you knew you wouldn't get into trouble, would you still want to do PE?" → C: "Yes" R: "Why?" → C: "Because I like PE" → C "I don't know."
3	**Other choice.** Child has chosen external (punishment) regulation as their other choice for PE. *Note.* Child **must state no** to the follow-up question.	R: "If you knew you wouldn't get into trouble, would you still want to do PE?" → C: "No" R: "Why?" → C: "Because I wouldn't get into trouble if I didn't do PE." → C: "I don't know why."
2	**Other choice**. Child has chosen external (punishment) regulation as their other choice for PE participation and articulates. *Note.* Child has said **yes** to the follow-up question and offers a deep or surface level/irrelevant response.	R: "If you knew you wouldn't get into trouble, would you still want to do PE?" → C: "Yes" R: "Why?" → C: "Because I like PE" → C "I don't know."
1	Not picked	Child does not pick identified regulation

Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):

Amotivation: I don't want to do PE.		
Question(s): *Out of all these reasons, which are your favourite reasons for doing PE? /* Follow-up question*: Why don't you want to do PE?*		
Code	Description	Example
5	First choice/Deep level response. Child has chosen amotivation as their first choice and articulates deep level responses for the amotivation regulation follow-up questions.	R: "Why don't you want to do PE?" →C: "I don't want to do PE because I'm not good at it." →C: "I don't see the point."
4	First choice/Surface or irrelevant level response. Child has chosen amotivation as their first choice and articulates surface level responses as to why they don't want to do PE.	R: "Why don't you want to do PE?" → C: "I don't know why." → C: "Because I like bonbons."
3	Other choice/Deep level response. Child has chosen amotivation as their other choice and articulates deep level responses for the amotivation regulation follow-up questions.	R: "Why don't you want to do PE?" →C: "I don't want to do PE because I'm not good at it." →C: "I don't see the point."
2	Other choice/Surface level or irrelevant response. Child has chosen amotivation as their other reason and articulates surface level responses as to why they don't want to do PE.	R: "Why don't you want to do PE?" → C: "I don't know why." → C: "Because I like bonbons."
1	Not picked	Child does not pick identified regulation
Comments (Their response to each question OR note if the child provided an irrelevant response, any notable or unique comments):		

Scoring by construct

Enjoyment

Drawing	Method Sub-sections	Maximum code	Actual code
	Like PE	4	
	Dislike PE	4	
	Combined (Like minus Dislike)	3	

Perceived Need Satisfaction

Relatedness	Method Sub-sections	Maximum code	Actual code
	Liked by PE teacher	4	
	Like of PE teacher	4	
	Inclusion by peers	4	
	Inclusion of peers	4	
	Total	16	
Autonomy	Pictorial	6	
	Autonomy supportive PE teacher part 1.	3	
	Autonomy supportive PE teacher part 2.	3 3	
	Total	15	
Competence	Overall star rating	9	

Self-determined motivation

Autonomous motivation		
Codes	Intrinsic regulation:	Identified regulation:
Mean of codes (Intrinsic + identified/2)		

Controlled motivation			
	Extrinsic regulations		
Codes	Reward (1):	Punishment (2):	Introjected regulation:
Mean of codes ((Extrinsic 1 + Extrinsic 2) + Introjection/2))			

Amotivation	
Code	

Figure 2 shows the amount of regulation types (out of six types) children chose across the sample. Children were able to choose as many regulation types as applicable to themselves. Figure 2 shows that there is a varied distribution of amount of regulation types chosen, indicating that children can not only explain how the different motivational regulations relate to them (Table 5) but can also reflect and differentiate between the different types of regulation by choosing between the different types, rather than picking them all.

Figure 2

The number of regulation types chosen by children (N = 78)